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The editor visits HMS Belfast and its permanent amateur radio station GB2RN

The Low Bands at Solar Minimum

Getting the most out of the LF bands

Rejuvenating the Yaesu FR-50B

Breathing new life into a classic receiver

144MHz QRP Contest Results

Results of the 2017 PW 144MHz QRP Contest

November 2017
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This month I want to talk about the great value that Elecraft offers. Probably the receiver performance is one of the most important aspects today. After all, if you can't hear them you can't work them. Take for example the K3S; the only radio that is better, costs a whopping £7,800. The little KX3 is only just behind the K3S at around £1,000. Of course some operators have brand loyalty. But when it comes to value and performance, there really is only one name. Elecraft.

Peter Waters G3OJV

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It is hard to believe that to beat the receiver performance of both these radios you would need to spend another £3,000 at least! You get top base station performance in a radio that you can take anywhere. No other portable HF radio gives you so much functionality and flexibility. The KX2 even has a built in mic., whilst the KX3 offers 2m or 4m options. It is not difficult to see why more and more operators are moving up to Elecraft. And to add to the fun, you can even opt to build the KX3 yourself if you wish. Both are available as ready built.

KX2 80m - 10m

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Built £859.95

- Pocket portable HF transceiver
- Built-in internal microphone
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KXBT2	Internal battery gives up to 8 hours operation from a single charge	**£69.95**

Elecraft K3S 160m-6m 10W or 100W

Join the "Club" and Experience Real Performance

100W Kit	£2849.95
100W Built	£2999,95
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- SSB CW AM FM
- New low noise synthesizer
- USB Port & 12m-6m extra pre-amp
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- Improved AF output design
- Now includes rx 470kHz band
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The K3S is the "sports car" of ham radio transceivers! Its under the bonnet that counts. The K3S certainly can out perform almost any other ham radio transceiver. Its fun to own and fun to operate. It is the most popular radio for DXpeditions for both performance and reliability.

Elecraft Receive Ratings*

1st	Flex-6700	£7800
2nd	**K3S**	**£2999**
3rd	**K3 no longer available**	
4th	IC-7851	£8,000
5th	PT-8000	£12,000
6th	**KX3**	**£1,000**

The performance positions are based on independent tests by Sherwood US Check: **www.sherweng.com**

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*"Terminal ID" and "Access Point" features will only work through an Icom D-STAR repeater enabled with the latest G3 Software. The ID-51E PLUS2 will function only as a normal D-STAR radio until this implementation occur.

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ICOM

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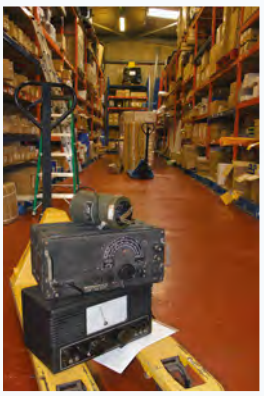

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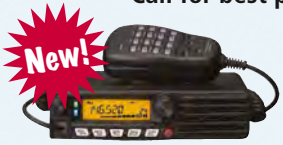

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Keylines

Don is thinking about new data modes, propagation, kits and construction, all topics prompted by the contents of this month's issue.

I commented on the new FT8 mode in my September *Keylines* **but hadn't anticipated just how rapidly it would grow in popularity.** This month it receives the attention of three of our columnists (*HF*, *VHF* and *Data Modes*), an indication of the mode's growing importance. However, as I said before, it only allows 'rubber stamp' QSOs so let's not forget that we can also use our hobby to have 'proper' contacts too – a topic that rears its head once again in this month's *Letters* pages. Apropos of which, there was a late flurry of letters this time round, more than I had allocated space for, so some have had to be held over until next month, for which I apologise.

Matters Practical

Our *Doing it by Design* and *Technical for the Terrified* columns have been running for some 11 years now under the authorship of **Tony Nailer G4CFY**. Sadly, Tony finds himself unable to submit copy for the foreseeable future. In the meantime, I hope to find others to fill his shoes. I know Tony's articles have always been well received and the compilation books and CDs are invariably best sellers at rallies and elsewhere.

This month, though, we have an interesting Arduino-based project from **Tony Jones G7ETW**, which I have run under the *Carrying on the Practical Way* banner but which falls somewhere between that and *Doing it by Design*. Indeed, projects such as this don't fall into a simple box. In this case, the hardware side will seem trivial to many old hands whereas the coding may be something of a mystery. To a younger generation, though, it may well be the coding that seems straightforward while they have less familiarity with a soldering iron. One member of my local club occasionally berates me (lightheartedly, I hasten to add!) for the old-fashioned (as he puts it) constructional articles we feature from time to time. But, then, he designs and builds electronic systems for a living, is comfortable with surface-mount construction and has an extensive array of test equipment. It's a tricky one but in these pages I try to achieve a balance, determined to some extent, of course, by what material I receive.

Meanwhile, I'll admit to having recently taken advantage of Maplin's August Bank Holiday sale to buy Arduino and Raspberry Pi 'starter' kits because I'm feeling out of the loop on these excellent hardware platforms.

Kits and Modules

Which leads nicely on to this month's pair of 'reviews' by **Geoff Theasby G8BMI**. Geoff and I are running these 'shorts' as something of an experiment. We can't usually point to a specific supplier and part number because the nature of these beasts is that they come and go. However, there will usually be something very similar on one of the popular auction sites. Our thinking is that, at the prices at which these kits and modules are being advertised, it's crazy to ignore them because you can end up with some handy shack accessories for a fraction of the cost of buying the components individually and often without the tricky soldering too. I'd welcome reader feedback on whether you find these short articles helpful.

Propagation

We also have another of **Steve White G3ZVW's** *Making Waves*. Steve tells me that he gets relatively little feedback on the column but what he does receive is invariably positive. One of the drawbacks of modern data modes (such as FT8, see above) is that they rather isolate the operator from what is actually happening on the air – often you cannot even hear the signal that is being received! That's great for commercial and military operators who, all too often, have little or no knowledge of radio propagation and rely of the equipment to find a path, whether by hopping to another frequency or, perhaps, selecting another antenna from a number that are available.

In our case, though, that knowledge of propagation is invaluable, whether, for example, in drawing up a band-change strategy for a multiband contest or deciding the best time and band to catch a DXpedition operation. Nowadays there are plenty of tools, both PC programs and online resources, to help with this but there is nothing to beat personal experience. I'll always recall a post on one of the club reflectors from an amateur who believed he had just worked an 8Q (Maldives) station on the 80m band. To me it didn't ring true – the Maldives had been in daylight for several hours at that time. I also recognised that by changing the Q to a P the callsign in question suddenly made sense as the callsign of an active Barbados amateur (8P, being the prefix for Barbados). My guess, based on knowledge and experience, turned out to be correct.

Of course, where HF propagation is concerned, greater distances aren't always harder. I recently had a play in the Scandinavian CW Contest and it was interesting, on 20m for example, to notice how Finnish stations were often workable while (closer) Danish or Swedish stations weren't. The answer is clear enough from this month's *Making Waves* column – the more distant signals were hitting the F layer at a more glancing angle and being refracted back to earth while the closer-in signals were simply passing through the F layer and out into space. All fascinating stuff!

Don Field
G3XTT

Practical Wireless

Warners Group Publications
The Maltings
West Street
Bourne
Lincs PE10 9PH

www.warnersgroup.co.uk

Tel 01778 391000

Editor (c/o Warners Group Publications)
Don Field G3XTT
practicalwireless@warnersgroup.co.uk

Designer
Mike Edwards
mike.edwards@warnersgroup.co.uk

Advertisement Sales
Claire Ingram
claire.ingram@warnersgroup.co.uk

Advertising Production and Design
Nicola Lock
nicola.lock@warnersgroup.co.uk

Publisher
Rob McDonnell
robm@warnersgroup.co.uk

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New Products from W&S

Waters & Stanton, the UK's official importer of AOR products, have announced the release of three new AOR products, the AR-DV10, AR-5700D and the AR-ALPHA-II.

The AR-DV10 is a handheld version of the very popular DV-1, an analogue and digital receiver covering 100kHz to 1300MHz. The AR-5700D provides 9kHz to 3700MHz coverage and like the DV-1 and DV-10 covers a number of digital modes (ten on the 5700D), including TETRA, P25, DMR and D-STAR. The AR-Alpha-II is the new flagship model and replaces the AR-ALPHA. It has coverage of 9kHz to 6000MHz in both analogue and ten digital modes. Pricing was yet to be advised, contact **sales@wsplc.com** or call 01702 204 965.

W&S, as UK importer of Elecraft products, have also announced a new microphone from Elecraft. The MH4 microphone is an enhanced replacement for the MH2, which is no longer available. It can be used with the K2, K3 and K3S transceivers. The MH4 has the same sensitive, high-performance element as the MH2 and can be used with the same bias and gain settings. Other than the plug, the MH4 is identical to the MH3 microphone, used with the KX2/KX3.

The MH4 has UP/DN controls, already supported by K2/K3/K3S firmware. On a K3 or K3S, UP/DN can be used to move the VFO or do channel hopping. On a K2, UP/DN alternates between VFO A and B. The MH4 has a slimmer, more modern form-factor than the MH2, along with a less bulky coiled cord and a removable bracket that can be used to hang the microphone in mobile applications. **www.wsplc.com**

Peterborough Club News

The August meeting of the Peterborough Club was an Activity Day at the club QTH. Starting around 10am, members turned up with projects to work on and equipment to test. Testing a homebrew HF vertical against a Sigma multiband SE HF 360 for the club QTH proved interesting, with the Sigma coming out the winner. Because antenna space is limited, it has to be a vertical.

Chip G1FJD brought along his FT-817 to fit a bhi noise reduction unit, a fiddly job but with help it was achieved and worked. He also brought along a couple of VHF antennas he had been given for checking on an analyser before use.

Tracey M5ATR started construction of the 10W linear kit to go with the dual-band Weekender radio she had recently completed.

Tony G0IAG brought along a Clansman PRC 320 to show members how to set up and operate it, while other members used the club HF radios on voice and PSK 31 modes.

With members coming and going all day and evening, small discussion groups setting up during the day and a great turn out of members in the evening, the day was an all round success and will be repeated.

Air Cadets Head up into the Sky

Friday September 1st saw the 106 Squadron Air Cadets set up camp ready for the Orsett Show that took place on the Saturday. As well as having a fund raising tent, the Squadron had a communication tent that was manned mainly by the cadets with support from members of the Thurrock Acorns Amateur Radio Club (TAARC). During the day the two stations contacted over 50 stations located in the UK and Europe, including Germany, Holland, Poland and Spain. As part of the cadets' training program there is the opportunity for them to be trained on the Squadron's two-way handheld radios, which were used by many of the cadets who acted as marshals during the day. An option in their communication training scheme gives the cadets the opportunity to train for their amateur radio licence and, to date, five cadets have passed the Foundation examination with two more on the training scheme. The Squadron already has an amateur radio station and it is hoped over the coming months to have a regular evening when the topic of radio and electronics will be explored.

Flt Lt Mark Jones RAFVR(T), commanding office of 106 Squadron said, *"I was delighted with the way all the cadets performed their different duties at the event. They were a credit to the Squadron".* 106 Squadron air cadets meet on a Monday and Wednesday evening at the Thames Gateway Cadet Centre, Hogg Lane, Grays RM17 5BW.

ML&S appointed Distributor for SGC Products

Martin Lynch & Sons have announced a new partnership with SGC of the USA. SGC are a world leader in the manufacture of remote antenna tuning units and associated products, supplying the amateur radio and military markets for many years. From September 2017 ML&S are able to offer their entire range, including the SG-230 200W and SG-235 500W remote tuners. For more information see:
www.HamRadio.co.uk/SGC

DXpedition News

Chris GM3WOJ and **Keith GM4YXI** will again activate the VK9CZ callsign from Cocos-Keeling Island from October 24th to November 7th with two stations. They will be on 160-10 CW, SSB and some RTTY and will be a multi-two in the CQWW DX SSB event October 28/29th. QSL via N3SL.
www.vk9cz2017.com

The upcoming November 9U4M Burundi DXpedition team plan to be active on FT8. They will be operational from November 6th to 17th.
www.mdxc.org/9u4m/2017/09/05/ft8-from-burundi

Bill G0VDE reports that his long-planned operation from St Helena as ZD7VDE is back on. He had booked one of the first commercial flights to the island but the planned flights were cancelled due to fears about wind shear on the approach to the runway. Flights from South Africa have now been approved, using smaller aircraft. Bill hopes to be there from October 14th with an FT-991, FT-891, Juma amplifier and various wire antennas. He plans to include the new FT8 mode in his operating schedule. For more information, including any possible further delays, see his website:
www.sthelenadx.com

A number of Caribbean DXpeditions that were planned for the CQWW Phone Contest at the end of October have been cancelled or their location changed. Details of forthcoming amateur radio DXpeditions, whether for contests or otherwise, can be found on the websites below. The NG3K site also has a large number of other amateur radio resources.
https://dx-world.net
www.ng3k.com

New SDR Product from Nevada

Nevada Radio have been appointed exclusive UK dealer for the new range of Aerial-51 Sky SDR transceivers manufactured in Europe.

First in the range is the SKY-One SDR, an 11-band, All-Mode 5W QRP transceiver. The SKY-SDR has most of the DSP features of larger HF transceivers – direct conversion, razor-sharp-adjustable filters, noise reduction, noise blanker, audio equaliser and even a built-in bandscope that works on receive and transmit. Its transmitter has a speech processor, audio equaliser and comes with a hand microphone at no extra cost. It also includes a USB CAT-Control with FTDI decoder and LINE IN/OUT for digital modes.

The transceiver is very portable, measuring just 130x110x80mm (incl. knobs) and weighs 580 grams. The SKY-One SDR is available exclusively from Nevada and priced at £699.
www.nevadaradio.co.uk

CHOTA 2017

Churches and Chapels on the Air (CHOTA) is an amateur radio event run annually under the auspices of WACRAL (The World Association of Christian Radio Amateurs and Listeners) in which stations are set up at, or very close to, historic churches. This year over 30 stations were involved.

CHOTA is timed to occur on the same day that many churches have their 'Ride and Stride' open days, when walkers and cyclists are sponsored to visit as many churches as possible.

The WACRAL station was set up at the porch of the very unusual church in Swilland in Suffolk. However, this year proved something of a dismal event. The solar flare that occurred a few days before together with being at the minimum point in the 11-year propagation cycle resulted in very few contacts.

In normal years, CHOTA stations try to connect with each other but this year CHOTA could have stood for Can't Hear anything On the Air! Many frustrated operators sat putting out *"CQ CHOTA"* calls but most bands were dead, with high noise levels.

The team at Swilland were operating with the callsign GB0SMS (Saint Mary's Swilland). Over several hours they managed to work five non-CHOTA stations in Spain, Portugal, Russia, Hungary and Germany.

In spite of the difficulties, which included the FT-450D reverting to default settings and failing to operate the Atas mobile antenna, **Paul M6PNC** and **Steve G0JFM** had a fun time and are looking forward to next year's CHOTA.

Ham Aid to the Caribbean

Following the various hurricanes that recently caused such havoc in the Caribbean, radio amateurs were involved in a number of ways. The ARRL, for example, supplied Ham Aid kits (complete portable stations) for use in Puerto Rico and the US Virgin Islands. A number of Hurricane Nets were established for passing health and welfare traffic. The ARRL photo shows equipment being packed for shipping. Extensive news reports are available on the ARRL website.
www.arrl.org

Exercise Blue Ham

UK Air Cadets will once again be running Exercise Blue Ham on 5MHz, over the weekends of October 21st/22nd and 28/29th from 08:00 to 20:00 local. There have been some changes to the scoring system and other aspects as a result of feedback from last year. Full details are available on the website below. As has been explained in *PW* previously, this is an opportunity for UK Full licensees to engage with Cadet stations on the 5MHz band.
https://alphacharlie.org.uk/exercise-blue-ham

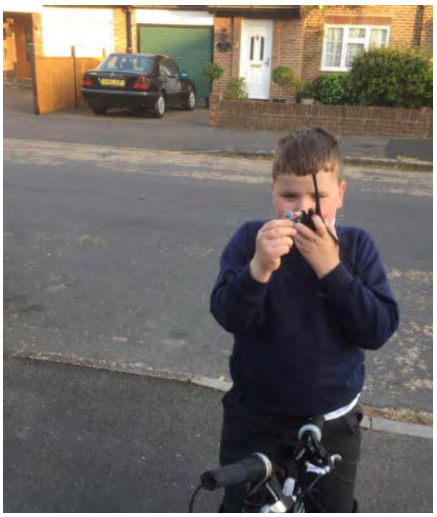
Project Thomas Watch

Project Thomas Watch came about after **James Preece M0JFP**, whose 11-year old Son (**Thomas**) is autistic, decided to try using walkie-talkie style radios to help give his son some independence while riding his bike. Thomas has just learned to ride and really enjoyed the freedom it gave him while James stood outside watching his son riding up and down and around the block. On occasion, Thomas would take longer than expected to do a lap of the block or sometime wander off too far, or just stop and sit down for a bit.

As a concerned parent, this made James have to go chasing around the street trying to find or call Thomas and became somewhat limiting. James wondered whether Thomas would use a small walkie-talkie type radio and respond to it when called. Thomas did after some instruction get used to using the radio and is able to report where he is and what he is doing. This helps give his dad peace of mind and allows him to start to trust Thomas and give him the independence he so wants in life.

"Other children in the street became curious about the radio and what we were up to", said Preece. *"We wondered about the licence implications and spoke to Ofcom. They suggested a simple business licence, which would allow anyone in the street (indeed, the whole UK) to use the radios".*

This was discussed at the Chertsey Club, who decided to run a raffle to raise the funds



and then approach the National Autistic society and share the project in their support. The project has been well received and the Club will update its social media and blog with local branch updates as they start using the radios.

For more information please visit the website or contact the Club via e-mail: **chertseyradioclub@hotmail.com** Twitter **@chertseyrc #projectthomaswatch http://chertseyradioclub.blogspot.co.uk/2017/05/test.html**

Wrexham Amateur Radio Society

On October 21st, Members of Wrexham Amateur Radio Society will put on a Special Event Station (SES) at the Brymbo Heritage Project, during their open day. They will use the callsign of GB1BSW and will operate on both the HF and VHF bands.

Wrexham Amateur Radio Society meets every first and third Tuesday at Brymbo Sports and Social Club, Brymbo from 7:30 (for an 8pm start). For more information, please see the website (below), or follow their Twitter and Instagram feeds – both at: **@GW4WXM** Contact Wrexham ARS via the Club Secretary, **Eifion Parry**, at: **wrexham.ars@gmail.com** or on 07484 100597
www.wrexham-ars.com

Chertsey Buildathon

Chertsey Radio Club ran its second Virtual Buildathon at the end of August. The project was a diplexer. They had 14 people join them from the UK, Europe and the USA. The session was presented by **Bob Conduit M6FLT** and hosted/filmed by **James Preece M0JFP**.

They used webex to share the build video in order to share webcam and audio between the group. The session was a real success and was enjoyed by everyone who joined in. The video can be viewed at: **http://chertseyradioclub.blogspot.co.uk/2017/09/virtual-build-thon-2-70-diplexer.html**

Kenya Gains 5MHz

Following a request from the Radio Society of Kenya (RSK), Kenya state radio regulator, CAK (Communications Authority Kenya) advised the RSK that a new 60m allocation has been granted between 5275kHz and 5450kHz on a secondary basis. All modes are permitted with a maximum power of 400W PEP.

UK Special Contest Callsigns

The UK's short Special Contest Callsigns have been mentioned several times recently here in *PW*. **Chris Tran GM3WOJ** has posted a history of their use on his website, below:
www.qsl.net/gm3woj/uksccs.htm

Kidderminster Repeater Group

The Kidderminster Repeater Group is having a talk by **John Scott G8UAE** on the subject of the BC-221 Frequency Meter on October 18th. The KRG meet every third Wednesday of the month at the Queens Head Public House in the village of Wolverley DY11 5XB, 19:30 for 20:00.
www.krg.club

• Tim Kirby, G4VXE, Willowside, Bow Bank, Longworth OX13 5ER E-mail: tim@g4vxe.com Twitter: @g4vxe

Review – The Retevis RT-82 144/430MHz Dual-Band DMR Radio

Tim Kirby G4VXE gets his hands on the first dual-band DMR handheld that we have seen.

Regular *PW* readers will have seen a variety of DMR radios reviewed in these pages, but all the ones that we have seen so far have been single-band (UHF) models. It's only in the last few months that we have started to see some dual-band (VHF/UHF) models reach the market.

It was with some interest then that I received an e-mail from **James Preece M0JFP** at the Chertsey Radio Club offering to send me one of the latest Retevis dual-band models, the RT-82, to have a look at.

Although I felt a dual-band model had to be a good thing, the fact that all but about two of the DMR repeaters in the UK are on UHF made me wonder how worthwhile a dual-band radio would be and whether it would be worth the extra money compared with a single-band model like the TYT MD-380.

What the Manufacturer Has to Say

Quite often the feature list of Chinese radios seems to lose a bit in translation so I've edited the list a little bit but the sidebar will give you a flavour of the features.

As far as I was concerned, the most important thing was to discover that the rig was compatible with Motorola Tier I and II. Some early dual-band models from other manufacturers weren't and thus a transmission ostensibly on one timeslot would tie up both timeslots, rendering the user not very popular on a local repeater although absolutely fine if you are only using a local hotspot.

First Impressions

On unboxing the rig, and clipping the battery on, the first impression is of a reasonably heavy unit, slightly heavier and larger than an MD-380, for example, but it's quite comfortable to hold in the hand.

The rig comes with a drop-in charger, a belt clip and an instruction manual. Mine came with a programming lead too but check with your vendor whether they supply one with the rig or not (you'll probably want one).

I found it reasonably easy to navigate the basic controls – switching on, adjusting the volume and so on. To change the Zone (usually you have a Zone for each DMR repeater you use) I discovered you had to use the small trackball in the centre of the front panel. I found using the trackball rather fiddly and I wasn't convinced how well it would stand up to getting wet or dirty, given that my handhelds tend to get damp when used on walks and outside.

Fortunately, I found a way, in the codeplug, which allows you to define what some of the various buttons on the rig do, programming the up/down buttons on the side of the rig to replicate the trackball's up/down functionality, which was much more positive to use.

James had kindly programmed the radio for me, with my DMR ID and some of my local repeaters, both analogue and digital. My first experiment was to see whether I could hear and access the local 2m FM repeaters, GB3WH and GB3RD, which are both a similar distance from me. Sure enough I could, although I felt reception was perhaps a little bit more noisy than I might have expected. On 70cm FM, I could similarly hear the local repeaters although, again, I felt they too were slightly noisier than I expected. More on that a little later.

The Swindon 70cm digital repeater GB7TC is fairly weak here on a handheld but I found that the rig picked it up as well as one of the other rigs would have done when placed in a strategic location. Of course, that's the great thing about digital – once you find those places and have a solid signal it's all Q5, no noise at all!

I also tried using the rig around the house, on low power, through my local digital radio hotspot on 70cm, the Shark RF openSPOT. It worked just fine for

The Retevis RT-82 alongside the TYT MD-380

accessing the various DMR networks available through the hotspot and I was pleased to get some good audio reports from a number of users. My thanks particularly to **Steven M6LBE** and **David M3EVF** for their help with some test contacts.

One thing that I was already enjoying about the rig was the ability to effectively monitor two channels at the same time, within a particular zone, so on a DMR repeater that might be two separate talkgroups or, if you have set up a zone for FM repeaters, you could monitor two different repeater outputs, for example.

A word, perhaps, about the instruction manual. It suffers somewhat from Chinglish. For example there's a section entitled 'Launch and Receive Calls' rather than 'Transmitting and Receiving' but as I've commented in previous reviews, so much of the operation of a DMR radio is down to the codeplug that the manual doesn't help hugely anyway. If you're the sort of person that likes to have a comprehensive user guide to refer to, though, this may not be for you.

Codeplug and Firmware Programming

I downloaded the programming software for the RT-82, installed it on my Windows 10 machine and connected up the USB cable. I was pleased to find that there were no problems establishing communication with the radio and performing functions such as adding repeaters, talkgroups, contacts and so on. As I mentioned before, I was able to program the side buttons to perform up and down, rather than using the trackball, which came as a great relief.

There's also the ability to update the firmware. Being a review model, I decided I wouldn't do that, but I'm interested to note that one version of the firmware allows 100,000 contacts to be stored and a second version allows you to store 10,000 contacts and to use an audio record function. The version of firmware that the radio came with did not appear to include a record function but it sounds as though that might be quite useful and worthy of investigation. You can download the revised firmware at the URL below. The download includes a utility to upload the firmware into the radio.

www.retevis.com/rt82-resources

Having just come back from two weeks by the sea, when the rig arrived I thought I'd program a couple of Marine channels into the rig while I was amending the codeplug. This worked very well when I was close to the Thames in London.

Performance Out and About

I was interested to see whether I could receive or use the 2m DMR repeater at Tring, GB7CT with the rig, because the signal seems quite strong at home on the collinear and if I listen on a mobile antenna but initial experiments proved unsuccessful. I was a bit puzzled and even checked in the codeplug that the correct frequencies had been programmed – they had. On my lunchtime walks in Central London, I found I could use GB7NS on 70cm quite successfully but not a peep from GB7CT on 2m.

Then a few days later, I was doing some reading and I found someone say that they hadn't found the performance of the supplied antenna very good, particularly on 2m. I wondered if that might have been the reason and fitted a Nagoya NA-771 dual-band antenna instead. It's a lot longer than the supplied antenna and I use it when I need a little more gain out of the handheld antenna.

On a walk up Faringdon Folly hill in west Oxfordshire, I tried to access GB7CT on 2m using the RT-82 and the NA-771 antenna. Success, whereas on the supplied antenna there was nothing at all. Similarly, on 70cm, the GB3UK analogue repeater some 35 miles away was inaudible on the standard antenna but readable and accessible on the NA-771. My impression is that the supplied antenna is fine for strong local signals but you might want to change it if, like

RT-82 Functionality

Frequency band: 136-174 & 400-480MHz
10,000 Contacts
IP67 Waterproof
(TDMA) digital function
Dual timeslot for repeater
Dual timeslot for point-to-point
Firmware upgradeable
GPS
Compatible with Motorola Tier I & II
Single/group/all call
Analogue and digital combined
Comply with digital protocol
ETSI TS 102 361-1,-2,-3
Colour LCD display
Up to 3,000 channels
Private/Group call match (Promiscuous)
Record
CTCSS/DCS
Monitor
VOX
TOT
Squelch
Keypad lock
Clock

Specifications as provided by Retevis

General Specification

Frequency	136-174 & 400-480MHz
Channel	3,000
Frequency Stability	± 1ppm
Operating Temperature	–30°C~+60°C
Operating Voltage	7.4V DC
Dimension (Hxuxd)	131.5x36.8x64
Weight	300g (with battery)
Battery Type	Li-ion
Battery Capacity	2200mAh
Antenna impedance	50Ω
Audio output power	1W @ 16Ω
Channel Spacing	12.5kHz

Transmitter

Power	UHF≤5W, VHF≥4W
Transmitter current	Analogue≤1.6A Digital≥0.9A
Standby current	0.18A
FM modulation mode	11K0F3E @ 12.5kHz 14K0F3E @ 20KHz 16K0F3E @ 25KHz
4FSK digital mode	12.5kHz(data only):7K60FXD 12.5kHz(data and voice):7K60FXW
Modulation distortion	<5%
Hum & Noise	≥45dB@25kHz ≥40dB@12.5kHz
Adjacent channel power	≥60dB@12.5kHz
Audio response	+1~–3dB
Digital protocol	ETSI-TS102 361-1,-2,-3

Receiver

Analogue Sensitivity	0.2μV @ 12dB SINAD
Digital Sensitivity	0.25μV(BER:5%)
Adjacent Channel Selectivity	≤–60dB@12.5kHz
Co-channel rejection	≥65dB
Spurious response	≥70dB
Audio response	+1~–3dB
Rated audio distortion	<5%
Audio power	1W
Modulation noise	≥45dB@25kHz ≥40dB@12.5kHz

me, you are also interested in more distant signals. From what I could tell, there weren't any issues with the receiver sensitivity.

Battery life seemed good and the supplied battery seemed to last for many operating sessions, particularly because I used the rig mostly on low power with the openSPOT around the house. The drop-in charger seemed quite quick to charge the rig, compared, especially, to the MD-380, which seems to take forever!

Comparing the RT-82 with other rigs, I noticed that it is almost identical to the MD-2017 dual-band transceiver, although the display is slightly different. So too, is the antenna connector, which on the MD-2017 is particularly fragile, a problem that happily does not seem to be the case on the RT-82. Compared to the MD-380, I missed some of the functionality improvements that have been added through the 'hacked' MD-380 Tools(z) firmware but I know that a variant of the 'hacked' firmware is being worked on for the MD-2017/RT-82 so hopefully that will be available in time. That said, should you decide to install the 'hacked' software, this is obviously not supported by the manufacturer or vendor.

Conclusion

Although, in practice, it was not particularly useful to me having DMR capability on 2m, it was nice to have a DMR rig that could also listen and transmit on 2m FM. I used that more than I thought. James M0JFP also programmed the rig to use on the AO-85 satellite. I suspect QSOs would be a bit hard to come by with that setup but it would be fine for receiving the satellite as well as the ISS voice and packet (you'll need to use a separate decoder). Decide for yourself whether you need a dual-band DMR rig. It's certainly nice having the two bands available on one rig rather than carrying a UHF DMR rig and an FM dual-bander and if you don't have an FM dual-bander already, the RT-82 would probably be cheaper than two separate rigs.

I wasn't fond of the trackball at all (I am trying not to write that I hated it) but I was glad that I was able to get around that by programming the side buttons on the rig. Other than that, I found the rig easy to use and didn't have to resort to the instruction manual, which was probably a blessing.

Bear in mind that the supplied antenna seems quite poor to me so be prepared to replace it – this need not be expensive to do. RF performance of the rig itself seemed good.

The review model didn't contain an onboard GPS but these are available at a small additional cost when you order the rig. In my view, there's little advantage, currently, in having GPS capability on your DMR rig, although the Brandmeister network is starting to add some GPS based functionality, which could be useful.

If you are in the market for a DMR radio the RT-82 is well worth looking at. My thanks to James M0JFP of the Chertsey Radio Club for the loan of the rig. The Retevis RT-82 is available in the UK, from Martin Lynch & Sons, priced £169.95.

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2017 PW 144MHz QRP Contest Results

Once again Colin Redwood G6MXL has a set of 144MHz QRP Contest Results – see how you did this year.

Despite the strong winds, 2017 saw 66 entrants submit logs in the 33rd *Practical Wireless* 144MHz QRP contest held on Sunday June 17th 2017. This represents an increase of over one-third in the number of entrants compared to 2016 (48 entrants). The entrants made a total of 2576 (1985) valid contacts with stations in 47 (40) different squares, **Fig. 1**.

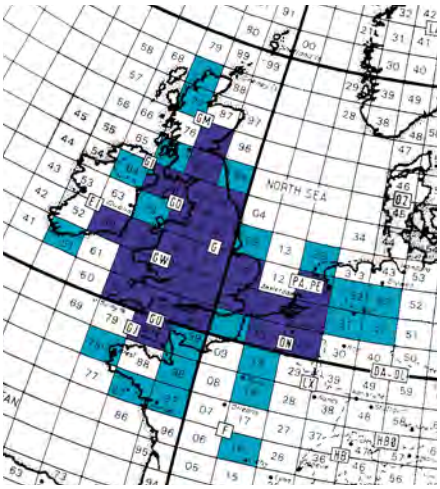

Fig. 1: Map showing locator squares of stations that entered (in dark blue) and other stations worked (light blue).

Fig. 2: The SADGITS team operating from Dorset.

2017 Winners

Demonstrating the advantages of height and a clear take-off, the overall winner, leading multi-operator and leading Welsh station is the **Hereford VHF Contest Group GW1YBB/P,** operated by **Steven Clements G1YBB** and **Paul G1YFC** from Pen-Y-Gadair (800m ASL), the second highest peak in the Black Mountains in South Wales (IO81KW). They used a Yaesu FT-817 transceiver and a 9-element DK7ZB antenna. They summed up the contest, "*GREAT! Great activity, great height, great radio conditions, but also great WIND. 4-season mountaineering tent poles both bent*".

In second place and the leading English station is the **SADGITS G4RLF/P**, operating from IO80WX using a Trio TS-770 + LNA and a 13-element Cushcraft antenna, **Fig. 2**.

The leading single operator station is **Steve Marsh G4TCU/P**, operating from IO82QJ.

The leading fixed station is the **Halifax & District Amateur Radio Society GX2UG,** operating from IO83XR.

The leading Scottish station is **Glenrothes & District Amateur Radio Club GM4GRC/P**, operating from IO86JF.

Fig. 3: The Wrexham Amateur Radio Society GW4WXM/P.

The leading GI/EI station is **Joe Bigham GI4TAJ/P**, operating from IO74AU.

The leading Channel Island station is **Chris Rees GU3TUX/P** from IN89VR.

The leading overseas station is **Jean-Jacques De Rey ON7EQ/P**, operating from JO10UT in Belgium.

Full details of the results can be found in the tables in this article. As usual certificates will be sent to all the leading stations above and the leading station in each square. Additionally, plaques will go to the leading Single- and Multi-Operator entrants.

Checklogs were received with thanks from **A G Stewart Wilkinson G0GLS, Bryan Turner G3RLE, Duncan Fisken GW3WZD/A, Tony Collett G4NBS, Don Field G3XTT/P** and **Colin Redwood G6MXL**.

Propagation & Activity

The general consensus among entrants was that conditions were generally fairly flat. Nevertheless some noted an increase in activity, although this was by no means universal.

Galashiels And District Amateur Radio Society GM4YEQ/P reported, *"No calls were heard from EI, GI, GD or the continent, which we have worked regularly in the past. No SOTA stations were heard, which is unusual because we hear*

Fig. 4: Alan Barnes M3AFF, operating from his garden.

Fig. 5: Andy Pym M6IQU is seen calling CQ, while Jon Wheeler G0IUE waits to log at Chippenham & District Amateur Radio Club G3VRE/P.

Fig. 6: The Bittern DX Group's G6IPU/P station was run by a YL team of operators comprising Sue Ziolkowska M6ZTT and Linda Leavold G0AJJ, supported by Adam Ziolkowski M0OAS, Thomas Ziolkowski M0TEO and Alec Adams G3YOA.

them calling from the Lake District most weekends. Several other Scottish stations to the north of us were heard very well but we failed to make a contact with them. The majority of our contacts were in a southerly direction with little traffic from the south-east or south-west. After a promising start at about 10:30, we had a major downpour and all signals faded. All we could hear was static till about 11:00 when the rain passed and the band opened again and several more stations worked."

Cambridge & District Amateur Radio Club G2XV/P found, *"Conditions at our location were good prior to the contest. However, the band went to average/below average. Little activity West through North, we guess due to the poor weather? Our location was much better than usual. To say we are disappointed with this result is an understatement."*

Tony Collett G4NBS submitted a checklog and said it was, "*Good to see so many portables and activity. A shame the Es didn't reach 2m till much later*".

Frank Laanen PE1EWR concurred, stating that, "*It was a pity that the Es opening came after the closing time of the contest, although the signals from SE Europe were not very strong. With surprising ease I managed to work three Welsh stations. I usually need all my power to get there! I really enjoyed working DX on Low Power and hope all participants did!"*

Second placed **SADGITS G4RLF/P** thought that, "*Conditions seemed flat with not much DX. However, we didn't struggle with too many contacts this year, so perhaps the extra two watts made some difference. Operating standards and transmission quality were much improved from previous years*".

Andrew Vare GW4XZL thought that, *"Band activity was good, better than last year, although there seemed to be very little activity from GM. No evidence of enhanced tropo conditions but still some good signals received from the continent. No issues with signals or overload despite the higher power this year."*

Pieter Smit submitted the **Hambleton Amateur Radio Society's** entry and said that, "*Overall radio conditions seemed relatively poor. We noticed a lot of fading. No Scottish or Irish stations were heard at all despite beaming in those directions."*

Wind and Rain

Strong winds and rain featured in the feedback from many entrants. For several this meant keeping antennas lower than planned, overcoming challenges to keep shelters from blowing away and early closing down.

Steve Marsh G4TCU/P says, "*I was hoping to complete the full time during this contest but struggled with winds of*

Description	Name/Team	Callsign
Overall Winner	Hereford VHF Contest Group	GW1YBB/P
Runner Up	SADGITS	G4RLF/P
Leading Fixed Station	Halifax & District Amateur Radio Society	GX2UG
Leading Single Operator	Steve Marsh	G4TCU/P
Leading Multi-Operator	Hereford VHF Contest Group	GW1YBB/P
Leading English Station	SADGITS	G4RLF/P
Leading Welsh Station	Hereford VHF Contest Group	GW1YBB/P
Leading Scottish Station	Glenrothes & District Amateur Radio Club	GM4GRC/P
Leading GI/EI Station	Joe Bingham	GI4TAJ/P
Leading Channel Islands Station	Chris Rees	GU3TUX/P
Leading Overseas	Jean-Jacques De Rey	ON7EQ/P

Table 1: Leading stations.

Square	Name	Call	No. entries
IN89	Chris Rees	GU3TUX/P	1
IO62	Paul Norris	EI3ENB	1
IO70	John Brooks	M0HJO	5
IO71	Simon Gosby	GW8OVZ/P	1
IO72	Carmarthen Amateur RS	GC4YCT/P	1
IO74	Joe Bingham	GI4TAJ/P	1
IO80	SADGITS	G4RLF/P	3
IO81	Hereford VHF Contest Group	GW1YBB/P	7
IO82	Steve Marsh	G4TCU/P	10
IO83	Michael Heywood	M0ICK/P	8
IO84	Yorkshire Dales CG	MX0YCG/P	3
IO85	Galashiels And DARS	GM4YEQ/P	1
IO86	Glenrothes & DARC	GM4GRC/P	1
IO90	Vecta Contest Group	M0VCT/P	2
IO91	Jon Page	G1POS/P	8
IO92	Ricky Amos Joe Hobbs	M0ZAV/P	2
IO93	Sheffield & District Wireless Society	G5TO/P	5
IO94	Hambleton ARS	G0JQA/P	2
JO01	Robert White	G4AGO	1
JO02	Cambridge & DARC	G2XV/P	4
JO10	Jean-Jacques De Rey	ON7EQ/P	1
JO11	807 ARO	PE1EWR	1
JO20	Walter Palings	ON7PX/P	1
JO21	Veron Afdeling Nieuwe Waterweg	PI4VNW	1
JO22	Contest Group Alkmaar	PI4ALK/P	1

Table 3: Square winners.

40 to 50MPH for the whole time. The antenna was damaged by the wind as the reflector was bent into a 'U' shape. It became clear it was getting dangerous and I was concerned the antenna might come crashing down. I struggled on for four hours and gave in. It was difficult to walk back down from the summit because several times I was blown off balance by powerful wind gusts. British summer indeed!"

The wind was no better farther north where the **Galashiels and District Amateur Radio Society GM4YEQ/P** were "*Sitting in cars in the low cloud with gale force wind and rain until the rain stopped. The rain was intermittent and sometimes very heavy, the wind was a constant strong south-westerly and consistently noisy. A beam antenna was erected at 12 feet (it was too windy to erect the mast any higher or to erect a tent) for the contest.*"

Glenrothes and District Amateur Radio Club GM4GRC/P also encountered many very heavy rain showers with strong gusty winds. They were pleased to work very well to the south of the UK.

In Northern Ireland it was no better, with heavy showers and horizontal rain/high winds reported by **Joe Bingham GI4TAJ/P**.

In North Wales, **Eiffon Parry MW6EYU**, Secretary of the Wrexham Amateur Radio Society GW4WXM/P, says they needed three people to hold down their tent on Nantyr Mountain, **Fig. 3**. Their perseverance paid off with 28 more contacts than last year!

Andrew GW4XZL/P says, "*The big feature for this year was the wind. It was so strong that I seriously thought that the shelter was going to be destroyed before it was even pegged down. Using every last piece of rope and string from the bottom of the kitbag and any nearby rocks, I managed to get it secure. I found it very difficult to hear the weak stations over the relentless howling wind noise, I didn't bring headphones unfortunately!*"

Simon Pryce GW0EIY/P found the weather was mostly dry but very blustery so he stayed in the car, which was a bit of a nuisance when he needed to turn the beam.

Simon Gosby GW8OVZ was, "*Disappointed this year because the wind was blowing very hard and I couldn't extend the antenna. In the end it was about one metre above ground level and directed with a rope of the back like a sail! After about 90 minutes it was too cold and damp in the cloud so I had to pack up.*"

Foundation

The *PW* contests are excellent ways for Foundation Licence holders to participate on a level playing field in a contest with others. Regular entrant **Alan Barnes M3AFF** operated from his garden, **Fig. 4**, while the Chippenham & District Amateur Radio Club G3VRE/P saw **Andy Pym M6IQU** on the microphone, **Fig. 5**.

A number of teams had Foundation Licence holders as participants. This year the **Bittern DX Group's G6IPU/P** station was run by a YL (young lady) team of operators comprising **Sue Ziolkowska**

M6ZTT and **Linda Leavold G0AJJ**. They were ably supported by **Adam Ziolkowski M0OAS**, **Thomas Ziolkowski M0TEO** and **Alec Adams G3YOA** who looked after the technical side of things and the all-important tea making, **Fig. 6**. This was Sue's first attempt at operating and logging in a contest and she really enjoyed the experience.

First-time

For **Martin Mills M0MLZ** it was his first time out in this contest. He says that he, *"Loved it and it was a great day".* It looks as though Martin was luckier than most with the weather, **Fig. 7**.

Welcome Back

Joe Bingham GI4TAJ first took part in the contest in 1985, making over 100 contacts. In 1998 he packed away his equipment as work and children took over from the hobby. Joe retired from teaching in 2016 and started operating again in November. Joe says, "*I've always enjoyed 2m SSB portable working so thought I would give the contest another go. The weather was OK at the start but as the morning progressed it changed to high winds and horizontal rain showers. The antenna, which is 30 years old, just wanted to point west into the wind so I had to get out of the car in the rain to turn it*."

Technical Problems

Besides the weather, Andrew GW4XZL/P had to content with technical problems, *"About 3 hours 40 minutes in, the logging PC crashed and then the rig locked on transmit – disaster! I got the rig working again but the logging PC kept crashing and I was just about to resort to a paper log when the horizontal rain arrived and the shelter started to leak badly so I reluctantly had to call it a day, again."* On a more positive note, Andrew observed that, *"at least no static rain this year!"*

On-board

Regular entrant **Dave Hewitt G(W)8ZRE** was off on a cruise on the day of the contest. It didn't prevent him from making a single contact before the ship left dock, **Fig. 8**. Dave says he'll be back on dry land next year and up the hills in Wales.

Contest Exchanges

At least one station was heard sending their contest exchange in a 'non-standard' sequence. Stations at the other end are expecting to hear both callsigns followed by their report (RST), serial number and locator. In some cases stations were heard sending their serial number and then their report. Not only does this make logging difficult (no matter whether using paper logs or computer logs) but in some cases it may not be obvious and can easily result in wrong details being logged. A case in point was where one station sent "you are 58 59 in …." This was logged as a RS 58 report and serial number of 059 by the station receiving the exchange. This was in fact an RS 59 report and their 58th contact (serial number of 58).

Frank Laanen PE1EWR noted that, *"One operator was clearly not very experienced: he gathered that I kept asking for information and kept on repeating serial and locator. But what I needed was his report, which he gave only once".*

Fig. 7: Martin Mills M0MLZ/P operated from his camper van.

Fig. 8: Dave Hewitt G8ZRE made a single contact before his cruise ship set sail.

Logging

Most logs were sent by e-mail. A variety of contest logging software was used by entrants. Logging accuracy varied a lot this year. Some stations submitted 100% or near 100% accurate logs. Others lost out with the /P missing from many callsigns. In some cases stations were inconsistent in sending /P with several stations who worked them noting this in their comments. One station compounded the problem with sometimes sending /A and sometimes /P.

Transcription errors such as swapping letters in callsigns, logging part of the station's own locator rather than the station being worked also contributed to loss of points.

Another station was somehow convinced that all locators start with IO and logged them as such, despite working many stations in locators starting JO and IN, resulting in the loss of many valuable multipliers and contacts. A quick sanity check of the log before submitting It, perhaps cross-referring to a locator map, could have spotted this.

Date for Your Diary

The provisional date for the 2018 *PW* 144MHz QRP Contest is Sunday June 11th 2017. As usual the event will be arranged to run alongside the RSGB 144MHz Backpackers contest for the benefit of entrants to both contests. Keep an eye on *Practical Wireless* and the PW Contest website at:
www.pwcontest.org.uk

Thanks

Many entrants expressed thanks to other stations taking part or giving points away. I would like to thank everyone who participated in 2017, and **Neill Taylor G4HLX** for devising what is without doubt one of the most widely supported single-band contests in the VHF calendar.

Pos'n	Call	Name	Single	QSOs	Squares	Score	Locator	Transceiver	Antenna	Ht. m asl
1	GW1YBB/P	Hereford VHF Contest Group		177	33	5841	IO81KW	Yaesu FT-817	9-ele Yagi	800
2	G4RLF/P	SADGITS		132	30	3960	IO80WX	Trio TS-770 + LNA	13-ele Cushcraft	277
3	M0VCT/P	Vecta Contest Group		116	29	3364	IO90JO	Yaesu FT-225RD + Mutek	7-ele Yagi	225
4	G4TCU/P	Steve Marsh	S	111	23	2553	IO82QJ	Kenwood TR-751e	A144S10	533
5	G0HAS/P	2 Men And A Dog		96	23	2208	IO81WG	Trio TR-751E + Pre-amp	8-ele LFA	230
6	GW4XZL/P	Andrew Vare	S	95	23	2185	IO82KA	Yaesu FT-817ND	9-ele Tonna	4
7	G1POS/P	Jon Page	S	96	21	2016	IO91AW	Yaesu FT-817	4 x 4-ele HB LFA Yagi	282
8	G0VHT/P	Paul Morrison	S	87	22	1914	IO91GI	Yaesu FT-857D	17-ele Tonna	297
9	GW4WXM/P	Wrexham ARS		91	19	1729	IO82KW	Trio TS-700 + Speech Proc.	10-ele	360
10	M0ICK/P	Michael Heywood	S	80	18	1440	IO83RO	Icom IC-7000	8-ele LFA HB	400
11	MC0YAD/P	Cwmbran And DARS		73	17	1241	IO81LQ	Yaesu FT-897	9-ele Tonna	310
12	G2XP/P	Sutton And Cheam RS		75	15	1125	IO91UH	Yaesu FT-817	7-ele Yagi	143
13	G0ROC/P	Rochdale & DARS		69	16	1104	IO83VP	Yaesu FT-991	11-ele Yagi	476
14	MX0YCG/P	Yorkshire Dales CG		81	13	1053	IO84VB	Yaesu FT-857	16-ele Yagi + 7-ele Yagi Vert	386
15	G5TO/P	Sheffield & District Wireless Society		44	18	792	IO93FL	Icom IC-7100	12-ele HB Yagi	320
16	G8HXE/P	Keith Haywood	S	50	15	750	IO83RO	Yaesu FT-817	SOTA SB5	380
17	GW0HRG/P	Halkyn Radio Group		44	17	748	IO83JG	Yaesu FT-817 + Pre-Amp	10-ele Cushcraft Yagi	270
18	G3XNO/P	Otley ARS		38	15	570	IO93DV	Trio TR-751E	Cushcraft Boomer	260
18	G2XV/P	Cambridge & DARC		38	15	570	JO02AH	Icom IC-7100 + DG 8 pre-amp	2 x 9-ele Tonna	14
20	M0ZAV/P	Ricky Amos Joe Hobbs		34	15	510	IO92OP	Yaesu FT-817	6-ele Cubical Quad	150
21	GW8OVZ/P	Simon Gosby	S	35	14	490	IO71OW	Yaesu FT-817	7-ele Yagi	530
22	G3VRE/P	Chippenham & DARC		37	13	481	IO81VJ	Icom IC-706 MKIIG	9-ele Tonna	120
23	G0JQA/P	Hambleton ARS		34	14	476	IO94IJ	Yaesu FT-847	9-ele Tonna	298
24	M1VHT/P	Keith Morrison	S	29	15	435	IO84VG	Yaesu FT-817	16-ele Cushcraft beam	668
25	G6IPU/P	Bittern Dx Group		36	12	432	JO02QU	Yaesu FT-847	17-ele Tonna	39
26	GU3TUX/P	Chris Rees	S	33	13	429	IN89VR	Yaesu FT-817	HB9CV	70
27	2W0JYN/A	Marches ARS	S	37	11	407	IO82LX	Icom IC-910	6-ele Yagi	200
28	GX2UG	Halifax & DARS		33	12	396	IO83XR	Yaesu FT-991	9-ele Tonna	400
29	GW0EIY/P	S.G.Pryce		33	10	330	IO82LQ	Yaesu FT-817 + BHI DSP + Mutek	5-ele Yagi	380
30	G8KVM/P	Bernard Rhead		26	12	312	IO93AD	Yaesu FT-817ND	3-ele Quad	396
31	M0HJO	John Brooks	S	28	11	308	IO70PP	Icom IC-910HX	9-ele Tonna	90
31	G3ASR/A	Edgware & DRS		28	11	308	IO91TN	Yaesu FT-817ND	5-ele Yagi	51
33	ON7EQ/P	Jean-Jacques De Rey	S	23	13	299	JO10UT	Yaesu FT-817	9-ele Tonna	135
34	GW6PVK/P	Gwil Jones	S	33	9	297	IO83LC	Yaesu FT-817ND	8-ele	300
35	G0IPE/P	Peter Gardner	S	24	12	288	IO90QV	Yaesu FT-897	5-ele Yagi	4
36	G4AGO	Robert White	S	22	13	286	JO01BR	Yaesu FT-290R MK1	9-ele Powabeam	80
37	M5AEO	Jonathan Kempster	S	35	8	280	IO91XM	Yaesu FT-897	5-ele Yagi	30
37	G3YDD	Hereford ARS		28	10	280	IO82PE	Yaesu FT-817	10-ele Yagi	105
39	GC4YCT/P	Carmarthen Amateur RS		21	13	273	IO72WA	Icom IC-7100	8-ele Yagi	381
40	G0OVA	Tony Crake	S	24	11	264	IO91PJ	Icom IC-7000	9-ele Tonna	75
40	M0MLZ/P	Martin Mills		24	11	264	IO70UM	Yaesu FT-991	9-ele Tonna	338
40	GW4MCQ/P	DMS Old Timers		33	8	264	IO81LS	Yaesu FT-857D	3-ele Quad	513
43	GI4TAJ/P	Joe Bingham	S	19	11	209	IO74AU	Yaesu FT-817ND	13-ele Tonna	340
44	PI4ALK/P	Contest Group Alkmaar		17	12	204	JO22IV	Icom IC-706 MKII	9-ele Tonna	15
45	G0FCA/P	Iain Groom	S	24	8	192	IO83VS	Icom IC-9000	8-ele Yagi	350
46	2E0VCC/P	Darrell Jones	S	18	10	180	IO70SP	Yaesu FT-857D	9-ele Tonna	261
47	PE1EWR	807 ARO	S	14	12	168	JO11SL	Kenwood TS-790E + 3SK121	10-ele Parabeam	9
48	G4TSW	Tiverton (SW) ARC	S	19	8	152	IO80FV	Yaesu FT-817ND + Digital filter	9-ele Yagi	241
49	G4PGJ	David Ward		16	9	144	IO92ET	Icom IC-7100	7-ele ZL Special	133
49	MW1DOU/P	Barry, Huw & Stuart		16	9	144	IO82CX	Yaesu FT-100	Diamond 10-ele Yagi	460
51	GM4YEQ/P	Galashiels And DARS		14	10	140	IO85MM	Yaesu FT-991	3-ele beam HB	485
52	GW1YQM	Richard Evans	S	16	7	112	IO82KR	Yaesu FT-817	17-ele Tonna	106
53	G1IZB/P	Frank Smith	S	9	10	90	IO93WH	Yaesu FT-857	8-ele loop Yagi	0
54	GM4GRC/P	Glenrothes & DARC		12	7	84	IO86JF	Yaesu FT-817ND	12-ele HB yagi	370
55	G7RHF/P	Al Rich	S	12	6	72	IO82QL	Yaesu FT-817	10-ele beam	274
56	M3AFF/P	Alan Barnes	S	12	5	60	IO70VT	Yaesu FT-817ND	5-ele HB Quad	350
56	G4YBS/P	Morecambe Bay ARS		12	5	60	IO84NA	Kenwood TS-2000X	5-ele Yagi	31
58	G8IBL	Huw Hallybone	S	13	4	52	IO91QE	Elecraft K3S	2x 9-ele Ms	90
59	PI4VNW	Veron Afdeling Nieuwe Waterweg		5	10	50	JO21BX	Kenwood TM-255 E	10-ele Yagi	25
60	G4CIB	Brian Woodcock	S	11	4	44	IO81VX	Icom IC-202S	5-ele ZL Special	20
61	ON7PX/P	Walter Palings	S	7	6	42	JO20HU	Yaesu FT-817 + preamp	9-ele Yagi	80
62	EI3ENB	Paul Norris	S	7	5	35	IO62JH	Yaesu FT-736R	13-ele Cushcraft Yagi	70
63	G4KKR/P	Richard Page	S	7	4	28	JO02PG	Yaesu FT-817	5-ele Yagi	62
64	G4AHO/P	Ken Jones	S	4	3	12	IO82XI	Icom IC-706 MKIIG	5/8 Vertical	0
64	G3YJR	G. J. Coyne		3	4	12	IO93FJ	Elecraft K3	9-ele Yagi	235
66	G8ZRE/P	Dave Hewitt	S	1	1	1	IO94GX	Yaesu FT-817	Rubber Duck	2

Table 2: Overall results table, PW 144MHz QRP Contest 2017.

Paul Morrison G0VHT E-mail: pwm.g0vht@gmail.com

QRP Contest

Elsewhere in this issue we have the results of this year's PW 144MHz QRP Contest. Here's Paul Morrison G0VHT's story, entering for the second time.

I have only formally entered one contest previously (and that was the *PW* QRP contest in 2015) despite being part of our wonderful hobby for the best part of 23 years.

So as a bit of fun, I rang my brother **Keith M1VHT** earlier this year and asked if he was wanted to enter the 2017 *PW* 144MHz QRP contest. His response was an immediate *"yes"* followed by the obligatory and expected quip *"you've got no chance bro",* so the challenge was on!

Keith lives in Northumberland and I'm down in Berkshire. We both immediately set about identifying potential locations to operate from. Within a couple of days, we were sorted. I decided to operate from Walbury Hill (IO91) near Hungerford, jokingly described as *"a mere molehill"* by my brother at 297m high. Despite this, research proved it was the highest hill in Berkshire and the highest natural point in south-east England. He, on the other hand, elected to drive down to a site near Hawes in the Yorkshire Dales (IO84), a whopping 667m above sea level. I clearly had my work cut out if I was going to have any chance of out-scoring my brother in this contest.

Station Planning

I realised that a decent 144MHz beam antenna was hugely important but I only owned a vertical collinear at home (most of my usual operating is HF). Kempton Park radio rally came to the rescue in the form of a second-hand purchase, an ageing but very impressive looking 17-element Tonna beam – all for the bargain price of just £35.

Roll forward a couple of weeks prior to the contest and the e-mails/text messages from my brother were coming in thick and fast with jibes about my choice of location and recently acquired 'elderly' beam. Keith really was raring to go, with everything in place for the big day. With this in mind I

The brothers, Keith and Paul – friends but contest rivals.

felt it was therefore time for a dry run of my own, setting up the station to iron out any potential problems before the event itself. On a lovely, calm Saturday morning, I drove to my local park and put together the antenna supported on an ex-military fiberglass swaged mast, clamped to the tow eye of my Land Rover.

The whole set up took almost two hours to complete from start to finish, much longer than expected but incredibly useful. Also, I didn't fully appreciate the length of the antenna boom, which proved to be over 20ft (6.1m) long when assembled! At least when the VSWR was checked, it was less than 1.3.1 in the segment of the band I was planning to use – what a relief!

Turning my attention away from the antenna, I decided to use my FT-857 because the recently revised competition rules now allowed a maximum of 5W RF output (the minimum output of an FT-857) and as it happened, the radio was already permanently installed in my vehicle. While this particular arrangement was not very power efficient for QRP operation, my leisure battery/vehicle charging system provided the necessary reassurance that there would be no flat battery or power related failures on the day.

As a precaution, I decided to take my trusty FT-817 and a 22Ah SLA battery with me, paired with a vertical antenna on a separate mast. This 'belt and braces' approach provided additional resilience to ensure most eventualities would be covered in the event that Murphy struck (or at least that's what I thought).

Contest Day

Finally, the day of the contest arrived. My brother and I set off at the crack of dawn heading for our respective mountains and molehills. The weather forecast for my area was cloudy but dry. However, the wind was expected to be quite blustery at a consistent 11MPH when arriving on site and the forecast warned that this would rise to over 16MPH by 2pm. What I wasn't expecting, however, was the ferocity and impact of the gusting winds but more about this later.

Once parked up, I set about putting the Yagi together, relieved that there were no other stations that beat me to this beautiful location. I was considerably quicker setting up this time around compared with my first attempt and within an hour I was in the front seat of the vehicle checking the layout and usability of my new portable 'shack'. With everything seemingly working well, out came my compass to help identify some general beam headings. These were scribbled on a piece of paper and held in place next to my antenna courtesy of my rear wiper blade – a perfect low-tech solution to save bringing out the compass every 15 minutes.

A quick phone call to my brother to agree a frequency, a tweak of the beam to a northerly direction and I gave him a call. Bingo! He came right back with a 54, a weak but perfectly readable signal report. By cranking up the speaker volume and running outside to turn the beam (by hand of course), Keith became a solid 59 signal in no time. This was a very encouraging start and we both agreed we would be each other's first contact when the competition began in earnest.

At 10am local time, that's exactly what we did although I immediately noticed his signal strength was down on our earlier contact. A quick check of the antenna identified the problem. The wind was picking up and had started to rotate the beam all by itself. I left it where it was because I wanted to get some contacts in the log and was hoping the problem would go

away. Unfortunately for me the beam kept rotating around at the behest of the swirling winds so I had no option other than to revert to plan B. The antenna was rapidly lowered and a length of Para cord rope tied to the front of the beam, dropping down to a metal stake that I hammered into the ground in the direction I wanted. That fix solved the wandering antenna problem. It wasn't pretty and it also wasted time when the beam heading needed to be changed.

Despite this, over the next couple of hours a steady, consistent stream of contacts found their way into my log. I settled on a strategy of fixed frequency calling combined with 15 minutes beaming in one direction followed by an incremental turn of the antenna of roughly 30° and a further 15 minutes of calling and so on, which I repeated until a full 360° circle had been completed. I would then simply reverse the process to stop the coax coiling up around the base of the mast and hoped to pick up some new stations on the way back.

A Change of Tactics

After a fairly active period, there was a bit of a lull in the proceedings. I admit to losing discipline at this point and changed strategy using the good old 'search and pounce' technique. To be honest, this ended up backfiring spectacularly because there were far too many *"we've worked before old man"* type comments – a result of a scribbled paper-based log and poor short-term memory. So it was back to the revolving beam, fixed frequency method.

By 1pm, the log was filling up nicely but the wind was ramping up with gusts of around 30 to 35MPH. On inspection, my beam was looking in a rather sorry state compared to when it was first erected, with two elements having worked loose from the boom and dropped to the ground (I knew hand-tight wasn't a good idea). The beam itself was now angled at 30° to the horizontal, twisted by a combination of strong winds versus the pegged down front end. Still, by this time I considered that I had passed the point of no return and defiantly soldiered on, come what may.

There were a handful of inquisitive individuals who approached me directly during the contest (mainly hill and dog walkers). I regretted not having printed an A3 note in the windscreen describing what I was doing and why in layman's terms. All I did in the cut and thrust of the contest was to acknowledge these people with a nod or wave of my hand and kept going – how odd and somewhat aloof I must have appeared to them.

Getting windy!

Unexpected News

A quick phone call from my brother brought the unexpected news that he was heading home. He had had enough of the strong winds and several heavy downpours. He told me his score and number of squares worked. I quietly enjoyed the moment as Keith magnanimously admitted defeat in relation to our brotherly challenge and wished me luck. Morale boosted, I was back in the contest!

Calling CQ repeatedly for a number of hours meant there was precious little time for a break so my cheese sandwiches remained in the kids' packed lunch box and all I managed to eat was the occasional chocolate bar. I was left wondering just how do serious DXers manage those extended 24/48 hour-plus contests? Hats off to them all.

Interestingly, I found almost all stations I worked to be incredibly courteous and polite, even when the conditions were hard going. Clearly the wind was playing havoc with a number of portable stations aside from me and there were plenty of humorous exchanges to this effect.

By 2.45pm local time, the wind was really making things difficult and the number of stations remaining in the contest tailed off considerably. I assessed my log and while noting a disappointing absence of Scottish contacts, I was really pleased to log stations from the Netherlands, Belgium, France and Germany – so pleased they joined the party and boosted my locator square multipliers.

There were several club stations that doggedly continued much to their credit but I made an executive decision to raise the white flag and pack up. If I'm honest, I was quite exhausted by then and my voice was more hoarse than red rum!

Lessons Learned

It took less than 45 minutes to load up the Land Rover and head back down Walbury Hill to the considerably milder climate of Windsor and Maidenhead, some 50 miles away. On the journey home I pondered to myself what lessons I had learned from this experience and what could I have done better. Well, the truth is many things and I'm not afraid to admit it.

Next time I intend to increase the robustness of my mast and replace the single long Yagi (unmanageable in windy conditions) with two or even three smaller independent antennas pointing North, South, East and West respectively – all coaxes will feed into a three-way switch, giving me the ability to switch direction in seconds and all without moving a muscle.

I must get myself a headset/microphone combination used in conjunction with my radio's VOX. Faffing about with a fist microphone, clipboard and pen was tricky in the confines of a vehicle.

Logging with paper is fine but I could have made my life so much easier (not to mention gaining a few extra points) had I used my Mac and logging software to speed up recording and quickly identify stations I'd worked before, thus helping with the search-and-pounce technique when the band appeared quiet.

Finally, I should have bought myself a decent masthead preamplifier. The number of times a station evidently heard me but was very hard to hear at my end was annoying to say the least.

In the end, this contest was seriously good fun and nothing could distract from that. It was both strenuous and exhilarating at the same time. I don't really mind where I end up on the scoreboard. I gave the contest my very best effort but, most importantly, I beat my brother's score by a healthy margin – something I will of course 'dine out' on for at least the next 12 months.

If you didn't enter the contest this year, I hope this article has encouraged you to have a go in 2018. I look forward to logging you then. Let's hope for a calm and dry summer's day next time.

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A lovely small compact Dual Band Transceiver but still with a 25W punch at a remarkable price – see our reviews on our website from some of the 1 thousand sold !!!

LEXION

VV-898S Dual Band Mobile Transceiver
New VV-898 "S" version now with 25W as standard – comes complete with keypad microphone, radio bracket all in a compact size with an a amazing compact price of just £69.95!

"NEW" Leixen VV-898SP Portable Dual Band Transceiver
Introducing the Leixen VV-898SP, the mobile backpack transceiver you can take virtually anywhere you need it! Leixen combined their micro-compact, 25 watt Dual Band UHF/VHF Mobile Radio with a powerful 12A Li-ion rechargeable battery and put it all in a sturdy chassis you can fit in your pack or emergency bag for use anytime, anywhere!
All for an amazing £149.95!

BAOFENG 寶鋒

Authorised dealer

Handheld

GT-3 136-174/400-480MHz transceiver..... £44.95
GT-5 (right) 136-174/400-520MHz transceiver..... £39.95
UV-5RC 136-174/400-480MHz transceiver..... £29.95
BF-888S 400-470MHz transceiver..... £14.95

Accessories

Speaker microphone..... £9.95
Software cable..... £9.95

TYT

Now you can go digital on the road with the TYT MD-9600 DMR Digital Mobile Two-Way Radio! The MD-9600 gives you crystal clear, noise-free audio of over-the-air digital communications in your vehicle, full analogue transceiver capabilities, and bundles it all together at a price you can afford!..... £279.95

RM

Amplifiers

The BLA 600 is a wideband compact linear amplifier for the HF bands and 6m, from 1.8 to 54 MHz Using Freescale MRFE6VP5600, Output 500W. Dual MCU Control, Fast PIN Diode RX-TX TX-RX switching enables QSK operation, 2x16 LCD Display for Amplifier Status, Separate LED displays for power and antenna VSWR, Input drive from 1W to maximum of 40W, 3 user configurable Antenna Output connectors, Dual large diameter MCU controlled, multispeed cooling fans for efficient cooling £1999.95

BLA350 1.5-30MHz 300w mains powered solid state amplifier £659.95
HLA305V 1.8-30MHz 250W professional amplifier with LCD £599.95
HLA300V+ 1.8-30MHz 300W all mode amplifier with fans £429.95
HLA150V+ 1.8-30MHz 150W all mode amplifier with fans £349.95
LA250V 140-150MHz 200W professional amplifier with LCD £499.95
ULA100 420-440MHz 100W compact linear for 70cms..... £399.95

LDG ELECTRONICS

Tuners

LDG Z-817 1.8-54MHz ideal for the Yaesu FT-817..... £129.95
LDG Z-100 Plus 1.8-54MHz the most popular LDG tuner..... £169.95
LDG IT-100 1.8-54MHz ideal for IC-7000..... £179.95
LDG Z-11 Pro 1.8-54MHz great portable tuner..... £179.95
LDG KT-100 1.8-54MHz ideal for most Kenwood radios..... £209.95
LDG AT-100 Pro II 1.8-54MHz..... £244.95
LDG AT-200 Pro II 1.8-54MHz..... £259.95
LDG AT-1000 Pro II 1.8-54MHz continuously..... £519.95
LDG AT-600 Pro II 1.8-54MHz with up to 600W SSB..... £394.95
LDG YT-1200 1.8-54MHz 100W for FT-450D, FT-DX1200 & FT-DX3000 £244.95
LDG YT-100 ideal for your Yaesu FT-857D..... £199.95
LDG AL-100 1.8-54MHz 100w designed for the Alinco range of transceiver £95

MFJ

Antenna Tuners

See our website for full details.
Automatic Tuners
MFJ-925 Super compact 1.8-30MHz 200W..... £199.95
MFJ-926B remote Mobile ATU 1.6-30MHz 200W..... £319.95
MFJ-927 Compact with Power Injector 1.8-30MHz 200W..... £309.95
MFJ-928 Compact with Power Injector 1.8-30MHz 200W £249.95 MFJ-929 Compact with Random Wire Option 1.8-30MHz 200W..... £259.95
MFJ-991B 1.8-30MHz 150W SSB/100W CW ATU..... £279.95
MFJ-993B 1.8-30MHz 300W SSB/150W CW ATU..... £309.95
MFJ-994B 1.8-30MHz 600W SSB/300W CW ATU..... £409.95
MFJ-998 1.8-30MHz 1.5kW..... £729.95

Manual Tuners

MFJ-16010 1.8-30MHz 20W random wire tuner..... £79.95
MFJ-902B 3.5-30MHz 150W mini travel tuner..... £134.95
MFJ-902H 3.5-30MHz 150W mini travel tuner with 4:1 balun..... £149.95
MFJ-904 3.5-30MHz 150W mini travel tuner with SWR/PWR..... £149.95
MFJ-904H 3.5-30MHz 150W mini travel tuner with SWR/PWR 4:1 balun £184.95
MFJ-901B 1.8-30MHz 200W Versa tuner..... £119.95
MFJ-971 1.8-30MHz 300W portable tuner..... £139.95
MFJ-945E 1.8-54MHz 300W tuner with meter..... £149.95
MFJ-941E 1.8-30MHz 300W Versa tuner 2..... £164.95
MFJ-948 1.8-30MHz 300W deluxe Versa tuner..... £174.95
MFJ-949E 1.8-30MHz 300W deluxe Versa tuner with DL..... £199.95
MFJ-934 1.8-30MHz 300W tuner complete with artificial GND..... £229.95
MFJ-974B 3.6-54MHz 300W tuner with X-needle SWR/WATT..... £229.95
MFJ-969 1.8-54MHz 300W all band tuner..... £249.95
MFJ-962D 1.8-30MHz 1500W high power tuner..... £339.95
MFJ-986 1.8-30MHz 300W high power differential tuner £399.95 MFJ-989D 1.8-30MHz 1500W high power roller tuner..... £439.95
MFJ-976 1.8-30MHz 1500W balanced line tuner with X-Needle SWR/WATT..... £589.95

Analysers

MFJ-259C 530 KHz to 230MHz..... £299.95
World's most popular SWR analyser is super easy-to-use. It gives you a complete picture of your antenna's performance. You can read your antenna's SWR and Complex Impedance 530KHz to 230MHz continuously with no gaps.

Power Supplies

PS30SWIII 30A peak switching power supply provides 13.8VDC at 20 Amps continuous, 30 Amps surge. The output voltage is adjustable from 9 to 15VDC. Red and black terminals on a rear panel (30A)
SPECIAL OFFER ~~£79.95~~ £69.95

PS30SWIV switching power supply provides 13.8VDC at 20 Amps continuous, 30 Amps surge. The LCD digital panel meter simultaneously displays voltage and current. There is a Noise Off-Set control that can be adjusted to eliminate pulse noise from the power supply.
SPECIAL OFFER ~~£79.95~~ £69.95

PS30SWII 25A continuous switch mode PSU with variable output voltage and cigar socket also includes noise offset function
SPECIAL OFFER ~~£99.95~~ £89.95

QJ1830SB 30 AMP Linear PSU, no noise issues with the great old school power supply unit, nice digital display and heavy as you like, so you feel like you bought something and don't offer this month.
SPECIAL OFFER ~~£129.95~~ £119.95

QJE QJPS30II 30 AMP Switch Mode Power Supply Unit
Includes noise offset control to eliminate the pulse noise of the switching circuit. This patent pending function is specially designed for communication equipment use. Its effectiveness may vary depending on the frequency and mode.
SPECIAL OFFER ~~£79.95~~ £69.95

QJE QJPS50II 50 AMP Switch Mode Power Supply Unit
Same as above but in a 50amp version
SPECIAL OFFER ~~£129.95~~ £119.95

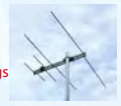
Want a new radio and get some money back for your old one?

Don't want the hassle of selling, queuing at the post office or paying online fees?

Part Exchange the easy way with 5 simple steps at Moonraker

1 Choose your desired rig, scanner or even accessory
2 Call or email what you would like to part exchange
3 We will be give you the best deal and agree the balance owed
4 Pack your equipment securely and wait for the door bell
5 Swap your old gear for shiny new with the delivery driver and enjoy! ..... it's that simple

Yagi Antennas



All Yagis have high quality gamma match fittings with stainless steel fixings! (excluding YG4-2C)

YG27-35 Dual band 3/5 element 3.5/12.5 dBd gain with one feed! £79.95
YG4-2C 2 metre 4 Element (Boom 48") (Gain 7dBd) £29.95
YG5-2 2 metre 5 Element (Boom 63") (Gain 10dBd) £69.95
YG8-2 2 metre 8 Element (Boom 125") (Gain 12dBd) £99.95
YG3-4 4 metre 3 Element (Boom 45") (Gain 8dBd) £79.95
YG5-4 4 metre 5 Element (Boom 104") (Gain 10dBd) £99.95
YG3-6 6 metre 3 Element (Boom 72") (Gain 7.5dBd) £99.95
YG5-6 6 metre 5 Element (Boom 142") (Gain 9.5dBd) £119.95

ZL Special Yagi Antennas

The ZL special gives you a massive gain for the smallest boom length … no wonder they are our best selling Yagis!

ZL5-2 2 Metre 5 Ele, Boom 95cm, Gain 9.5dBd £69.95
ZL7-2 2 Metre 7 Ele, Boom 150cm, Gain 11.5dBd £79.95
ZL7-70 70cm 7 Ele, Boom 70cm, Gain 11.5dBd £49.95
ZL12-70 70cm 12 Ele, Boom 120cm, Gain 14dBd £59.95

HB9CV

Brilliant 2 element beams … ideal for portable use

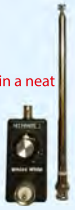
HB9-2 ..... £34.95
HB9-4 ..... £49.95
HB9-6 ..... £59.95

Halo Loops

Our most popular compact antennas, great base, mobile, portable, or wherever!

HLP-4 4 mtr (size approx 600mm square) £44. 95
HLP-6 6 mtr (size approx 800mm square) £49.95

QRP Antennas



The Moonraker Whizz range are great for getting on HF in a neat compact and totally portable way

WhizzWhip HF/VHF/UHF portable antenna with telescopic whip - ideal for any situation where a long wore or vertical antenna is just not an option - get on air today for just £99.95

Whizz Loop 20-60m compact loop is ideal for QRP Transceivers when space is limited or using portable with a Yaesu FT-817ND or similar. Can be used indoors with surprising results and handy for travelling due to its "pocket" size antenna ideal for indoor or out and can be packed away and all for just £69.95

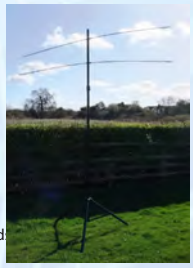
Whizz Loop V2 (right) same as above but with a frequency range from 40-10m £79.95

Base Antennas

Simple plug and play HF antennas radial free and at a great price

GP2500 All Band 80-6M Vertical TX 80-6M RX 2-90MH Power 250W Length 7.13M £199.95
GPA-80 budget version of GP2500 80-6M Length 6.0M £99.95

Portable HF Kits



Great dual band kits for portable use, two compact dipoles on an upto 14ft mast just requires coax

PK1217 HF Kit for 12/17M ... £149.95
PK1520 HF Kit for 15/20M ... £149.95
PK3060 HF Kit for 30/60M .. £154.95
PK4080 HF Kit for 40/80M ... £159.95
(please note each kit requires two feed

Mobile Antenna Mounts

TRIMAG-S Triple magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – ideal for those larger antennas just £39.95
TURBO-S single 170mm magnetic mount with SO239 antenna fitting with 4m RG58 and PL259 fitted – will suit most antennas upto 5ft. £19.95
HKITHD-SO Heavy duty hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted £32.95
HKITM-S Mini hatch back mount with SO239 antenna fitting with 4m RG58 and PL259 fitted £32.95

Multiband Mobile

Why buy loads of different antennas when Moonraker has one to cover all! SPX series has a unique fly lead and socket for quick band changing

SPX-100 9 Band plug n' go portable, 6/10/12/15/17/20/30/40/80m, Length 165cm retracted just 0.5m, Power 50W complete with 38th PL259 or BNC fitting to suit all applications, mobile portable or base - brilliant! £44.95
SPX-200S 6 Band plug n' go mobile, 6/10/15/20/40/80m, Length 130cm, Power 120W, PL259 fitting £44.95
SPX-300S 9 Band plug n' go mobile, 6/10/12/15/17/20/30/40/80m, Length 165cm, High Power 200W, PL259 fitting £59.95

VHF/UHF Mobiles

GF151 Glass Mount 2/70cm, Gain 2.9/4.3dBd, Length 78cm complete with 4m cable and PL259 ..... £29.95
MRM-100 MICRO MAG 2/70cm, Gain 0.5/3.0dBd, Length 55cm, 1" magnetic base with 4m coax and BNC £19.95
MR700 2/70cm, Gain 0/3.0dBd, Length 50cm, 3/8 fitting £9.95
MR777 2/70cm, Gain 2.8/4.8dBd, Length 150cm, 3/8 fitting £19.95
MRQ525 2/70cm, Gain 0.5/3.2dBd, Length 43cm, PL259 fitting (high quality) £19.95
MRQ500 2/70cm, Gain 3.2/5.8dBd, Length 95cm, PL259 fitting (high quality) £26.95
MRQ750 2/70cm, Gain 5.5/8.0dBd, Length 150cm, PL259 fitting (high quality) £36.95
MRQ800 6/2/70cm Gain 3.0dBi/5.0/7.5dBdBd, Length 150cm, PL259 fitting (high quality) £39.95
MRQ2732/70/23cm Gain 3.5/5.5/7.5dBdBd, Length 85cm, PL259 fitting (high quality) £49.95
MRQ900 10/6/2/70cm Gain 10m (2.15dB) 6m (2.5dB) 2m (2.8dB) 70cm (5.5dB) Length: 125cm PL259 fitting £49.95

Coax Switches

CS201 2 Way Switch 3 X SO239, 2500W 1-1000MHz £19.95
CS201N 2 Way Switch 3 X N-Type, 2500W 1-1000MHz £24.95

Lightning Arrestors

ST-1 SO239 to PL259 adapter with earth wire connection £4.95
CDX-1 Lightning Arrestor 2 X SO239 sockets 400W £19.99

Dummy Loads

DL-15 PL259 DC-800MHz 15W CW 20W 50 Ohms £24.95
DL-15N N-Type DC-800MHz 15W CW 20W 50 Ohms £29.95

SWR Meters

SWR-100 Frequency 26-30MHz 100W 50 Ohms £16.95
SWR-270 Frequency 120-500MHz 100W 50 Ohms £29.95

Ferrites

High quality ferrites to suit all the popular cables

FCS-S to suit 6mm cable such as RG58 ..... £1.95
FCS-M to suit 7mm cable such as MINI8 ..... £2.95
FCS-L to suit 9mm cable such as RG213 ..... £3.95

GRP Fibreglass Base Antennas Diamond quality – Moonraker pricing

Diamond quality – Moonraker prices ! These high gain antennas have been pre-tuned for your convenience, easy to use, easy to install, and a choice of connection … look no further

SQBM100P 2/70cm 3.00/6.00dBd, RX 25-2000MHz, Length 100cm SO239 ..... ~~£49.95~~ special offer £39.95
SQBM200P 2/70cm, Gain 4.5/7.5dBd, RX 25-2000MHz, Length 155cm, SO239 ..... ~~£54.95~~ special offer £44.95
SQBM500P 2/70cm, Gain 6.8/9.2dBd, RX 25-2000MHz, Length 250cm, SO239 ..... ~~£74.95~~ special offer £69.95
SQBM800N 2/70cm, Gain 8.5/12.5dBd, RX 25-2000MHz, Length 520cm, N-Type ..... ~~£139.95~~ special offer £99.95
SQBM1000P 6/2/70cm, Gain 3.0/6.2/8.4dBd, RX 25-2000MHz, Length 250cm, SO239 ..... £84.95
SQBM223N 2/70/23cm, Gain 4.5/7.5/12.5dBd, RX 25-2000MHz, Length 155cm, N-Type £79.95
SQBM4010P Quadband 10/4/2/70cm Gain 2.5/3.2/3.6/5.5dBi Length 120cm £69.95
SQBM6010P Quadband 10/6/2/70cm Gain 2.5/3.0/3.6/5.5dBi Length 120cm £69.95
SQBM4060P Quadband 6/4/2/70 Gain: 2.5/3.0/3.6/5.5dbi Length 120cm £69.95

HF Wire Antennas

All our HF wire antennas are made with complete waterproof potted baluns and high quality "original" flexweave antenna wire.

MDHF-80 3.5MHz balun matched mono dipole, length 40m £59.95
MDHF-40 7.0MHz balun matched mono dipole, length 20m £44.95
MDHF-20 14MHz balun matched mono dipole, length 10m £39.95
OSHF-80 3.5-30MHz balun matched off set dipole, length 40m £59.95
OSHF-40 7.0-30MHz balun matched off set dipole, length 22m £44.95
OSHF-20 14-30MHz balun matched off set dipole, length 11m £39.95
LWHF-160 1.8-50MHz unun match end fed antenna, length 42m £49.95
LWHF-80 3.5-50MHz unun match end fed antenna, length 20m £44.95
LWHF-40 7.0-50MHz unun match end fed antenna, length 10m £39.95

HF Mobiles

Get great results with the Moonraker range of HF mobiles! … from as little as £22.95!

AMPRO-10 Slim line design 28MHz 2m approx. 3/8th fitting £22.95
AMPRO-11 Slim line design 27MHz 2m approx. 3/8th fitting £22.95
AMPRO-12 Slim line design 24MHz 2m approx. 3/8th fitting £22.95
AMPRO-15 Slim line design 21MHz 2m approx. 3/8th fitting £22.95
AMPRO-17 Slim line design 18MHz 2m approx. 3/8th fitting £22.95
AMPRO-20 Slim line design 14MHz 2m approx. 3/8th fitting £22.95
AMPRO-30 Slim line design 10MHz 2m approx. 3/8th fitting £22.95
AMPRO-40 Slim line design 7MHz 2m approx. 3/8th fitting £22.95
AMPRO-60 Slim line design 5MHz 2m approx. 3/8th fitting £24.95
AMPRO-80 Slim line design 3.5MHz 2m approx. 3/8th fitting £27.95
AMPRO-160 Slim line design 28MHz 2m approx. 3/8th fitting £59.95

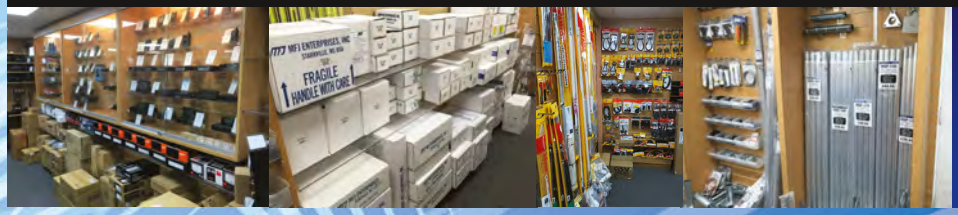
Other frequencies available. Call or see online for more details.

Baluns & Ununs

High quality TX, RX baluns, and Ununs all fully potted and weather protected with SO239 socket

MB-1 1-30MHz 1:1 Current Balun 400W 50 Ohms £29.95
MB-4 1-30MHz 4:1 Current Balun 400W 50 Ohms £29.95
MB-6 1-30MHz 6:1 Current Balun 400W 50 Ohms £29.95
MB-1X 1-30MHz 1:1 Current Balun 1000W 50 Ohms £39.95
MB-4X 1-30MHz 4:1 Current Balun 1000W 50 Ohms £39.95
MB-6X 1-30MHz 6:1 Current Balun 1000W 50 Ohms £39.95
MU-9 1-50MHz 9:1 Unun 500W 50 Ohms £29.95
LWB-1 0-40MHz Receive only 50 Ohms £24.95

COME AND VISIT US FOR A BROWSE, FRIENDLY IMPARTIAL ADVICE AND EXTRA INSTORE DISCO



OPEN NOW

The largest stockist of Amateur, Scanner, CB and Hobby Radio products for 60 miles around. Plenty of parking and easy access from the M1 – come for a visit soon.

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Our website shows real-time stock so you can buy with confidence

Cable

RG58 Standard, 5mm, 50 ohm, per metre £0.35
RG58-DRUM-50 Standard, 5mm, 50 ohm, 50m reel £19.95
RG58-DRUM-100 Standard, 5mm, 50 ohm, 100m reel..... £29.95
RG58M Mil spec, 5mm, 50 ohm, per metre (best seller)..... £0.60
RG58M-DRUM-50 new 50m reel of mil spec RG58 in a great handy size only £24.95
RG58M-DRUM-100 Mil spec, 5mm, 50 ohm, 100m reel £44.95
RGMINI8 Mil spec, 7mm, 50 ohm, per metre, (amateur favourite)£0.75
RGMINI8-DRUM-50 mil spec, 7mm, 50 ohm, 50m reel £34.95
RGMINI8-DRUM-100 Mil spec, 7mm, 50 ohm, 100m reel £64.95
RG213 Mil spec, 9mm, 50 ohm, per metre £1.30
RG213-DRUM-50 Mil spec, 9mm, 50 ohm, 50m reel..... £59.95
RG213-DRUM-100 Mil spec, 9mm, 50 ohm, 100m reel..... £109.95
300-20M Ladder Ribbon, best USA quality, 300 ohm, 20m pack£17.95
300-DRUM Ladder Ribbon, best USA quality, 300 ohm, 100m reel £69.95
450-20M Ladder Ribbon, best USA quality, 450 ohm, 20m pack£19.95
450-DRUM Ladder Ribbon, best USA quality, 450 ohm, 100m reel £79.95

Antenna Wire

Perfect for making your own antennas, traps, long wire aerials etc.
SEW-50 Multi stranded PVC covered wire, 1.2mm £19.95
SCW-50 Enamelled copper wire, 1.5mm..... £24.95
HCW-50 Hard Drawn bare copper wire, 1.5mm..... £29.95
CCS-50 Genuine Copperweld copper clad steel, 1.6mm £29.95
FW-50 Original Flexweave bare copper wire, 2mm £39.95
FWPVC-50 Original clear PVC covered copper wire, 4mm £44.95
FW-100 Original high quality flexweave antenna wire, 100m reel..... £59.95
FWPVC-100 Original PVC coated flexweave antenna wire, 4mm, 100m reel..... £79.95

Rigging Accessories

Get rigged up, for full list of all options visit our website!
PULLEY-2 Adjustable pulley for wire antennas, suits all types of rope..... £24.95
GUYKIT-HD10 Complete HD adjustable guying kit for up to 40ft masts..... £54.95
GUYKIT-P10 Complete LD/portable guying kit to suit up to 40ft masts..... £39.95
SPIDER-3 Fixed 3 point mast collar for guy ropes..... £5.95
SPIDER-4 Fixed 4 point mast collar for guy ropes..... £6.95
PTP-20 Pole to pole clamp to clamp up to 2" to 2"..... £5.95
DPC-W Wire dipole centre to suit either 300 or 450ohm ladder line £5.95
DPC-S Wire dipole centre with SO239 to suit cable feed connections..... £6.95
DPC-A Dipole centre to suit ½ inch aluminium tube with terminal connections..... £7.95
DPC-38 Dipole centre with SO-239, 3/8th sockets to make mobile dipole £6.95
DOGBONE-S Small ribbed wire insulator..... £1.00
DOGBONE-L Large ribbed wire insulator £1.50
DOGBONE-C Small ceramic wire insulator £1.20
EARTHROD-C 4ft copper earth rod and clamp £24.95
EARTHROD-CP 4ft copper plated earth rod and clamp £16.95
G5RV-ES In-line SO239 replacement socket for 300 or 450 ohm ladder line..... £6.95
AMA-10 Self amalgamating tape for connection joints, 10m length..... £7.50

Portable Telescopic Masts

LMA-S Length 17.6ft open 4ft closed 2-1" diameter.... £79.95
LMA-M Length 26ft open 5.5ft closed 2-1" diameter .. £89.95
LMA-L Length 33ft open 7.2ft closed 2-1" diameter.... £99.95
CARPLATE-HDT brilliant drive on plate with tilt – ideal to be used in conjunction with the portable telescopic masts and only £44.95
CARPLATE-HD without tilt £24.95

20ft Swaged Mast Sets

(5ft Sections)

These heavy duty masts sets have lovely push fit swaged sections to give a strong mast set. Ideal for portable or permanent installations also available singly
MSP-125 4 section 1.25inch OD mast set £39.95
MSP-150 4 section 1.50inch OD mast set £44.95
MSPX-150 heavy duty 2.65mm 1.50 inch OD mast set..... £59.95
MSP-175 4 section 1.75inch OD mast set £49.95
MSP-200 4 section 2.00inch OD mast set £59.95
MSPX-200 heavy duty 2.65mm 2.00 inch OD mast set..... £79.95

Telescopic Masts

TMF-1 Fibreglass mast ★ 4 sections 160cm each ★ 50mm to 30mm ★ Approx 20ft erect 6ft collapsed..... £179.95
TMF-1.5 Fibreglass mast ★ 5 sections 200cm each ★ 60mm to 30mm ★ Approx 30ft erect 8ft collapsed £249.95
TMF-2 Fibreglass mast ★ 5 sections 240cm each ★ 60mm to 30mm ★ Approx 40ft erect 9ft collapsed..... £299.95
TMF-3 Fiberglass mast * 6 sections 240cm each * 65-23mm * Approx 50ft erect 8ft collapsed..... £349.95

Patch Leads

PL58-0.5 ½m Standard RG58 PL259 to PL259 lead £3.50
PL58-10 10m Standard RG58 PL259 to PL259 lead..... £8.95
PL58-30 30m Standard RG58 PL259 to PL259 lead..... £16.95
PL58M-0.5 ½m Mil Spec RG58 PL259 to PL259 lead..... £4.50
PL58M-10 10m Mil Spec RG58 PL259 to PL259 lead £12.95
PL58M-30 30m Mil Spec RG58 PL259 to PL259 lead £27.95
PL213-10 10m Mil Spec RG213 PL259 to PL259 lead £18.95
PL213-30 30m Mil Spec RG213 PL259 to PL259 lead £39.95
PL103-10 10m Mil Spec Westflex 103 PL259 to PL259 lead.... £29.95
PL103-30 30m Mil Spec Westflex 103 PL259 to PL259 lead.... £69.95
(All other leads and lengths available, ie. BNC to N-type, etc. Please phone for details)

PAM Kit A great portable freestanding tripod which can be extended to 4m. Perfect for field days at a perfect price. Just £59.95 complete

Mounting Hardware & Clamps

We have all the mounting brackets you could possibly want - for all options see our website
TRIPOD-HDA Free standing, heavy duty, fold away tripod, which adjusts from 50-65mm £149.95
TRIPOD-25L Free standing heavy duty tripod to suit masts 65mm or less..... £79.95
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Feature by Dr Samuel Ritchie EI9FZB

Dr Samuel Ritchie EI9FZB E-mail: practicalwireless@warnersgroup.co.uk

Rejuvenating the Yaesu FR-50B Receiver – Part 1

Dr Samuel Ritchie EI9FZB restores an old Yaesu FR-50B receiver, explaining both the workings of the set and the step-by-step process of restoration.

My first amateur receiver was a third- or fourth-hand Yaesu FR-50B. I learned to tune SSB the old-fashioned way and sat up many nights listening to amateurs and broadcast stations while using a longwire antenna. The radio chassis was already badly rusted when I got it and after two decades and while packing to move to another continent I had no choice but to consign it to the dump.

Then there was eBay and in 2012 I was able to pick up a well-used replacement. I spent a few weeks repairing, aligning, undoing the previous owner's poor workmanship and enjoying tuning around the pre-WARC bands once again with a 1960s piece of technology.

More recently I again noted a number of these receivers being traded on eBay. I thought it might be of value to share what I have learned and the editor agreed.

Background

The Yaesu F-line, which included the FR-50 receiver, came out in 1966 at a time when amateur radio transceivers were not common and receivers usually had a matching transmitter. In this case the matching transmitter was the FL-50. When paired with the FR-50, it used the receiver's variable frequency oscillator (VFO) to also set the frequency of transmission. In Europe these radios were also marketed under the Sommerkamp brand name and often appear in this guise.

In 1969 the B model was released with what appear to be small changes in the front panel layout and internal improvements to the mechanical filters, until 1973 when the FR/FL-50B production line was closed.

The user manual and schematics are freely available for download on the internet and if you don't have these, you should download a copy of each to follow these articles. My assumption is that your receiver works to some degree and that damaged valves or components have been repaired. If not, then you may need some expert assistance to get you going.

Approach

In this first part, I cover:

- how this radio converts radio signals into audio – a discussion on how this double conversion receiver works;
- why this radio struggles to separate closely spaced signals – a discussion on what is 'selectivity' and why this receiver suffers from a lack of selectivity;
- the missing link; and removing the chassis from the cabinet.

The second article will cover:

- why electrolytic capacitors age and how to go about changing these capacitors in an FR-50B; and
- the reported problem of this receiver model drifting in frequency and how to cure this instability.

The third and final article covers:

- being sure of what frequency you are tuned to – adding a frequency counter,
- what is AGC and sorting out this receiver's AGC problem; and
- advice on aligning the receiver.

At least some of the discussion will be relevant to rejuvenating other radios of a similar vintage.

Converting RF to Audio

I have drawn a basic block diagram of the FR-50B receiver, **Fig. 1**. The frequen-

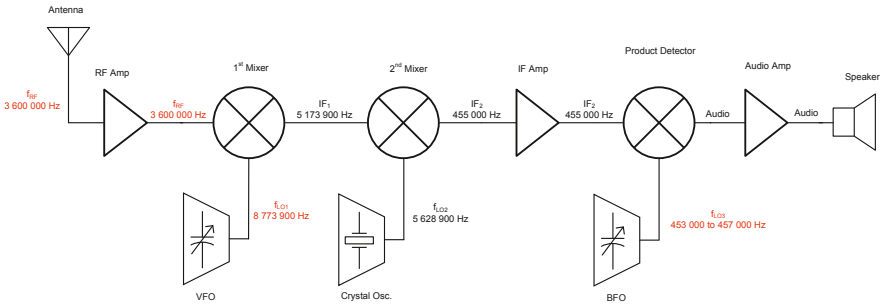

Fig. 1: Basic block diagram of the FR-50B.

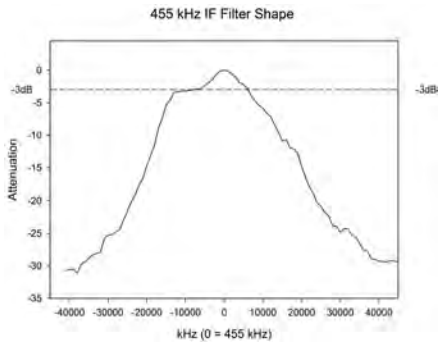

Fig. 2: 455kHz IF filter shape.

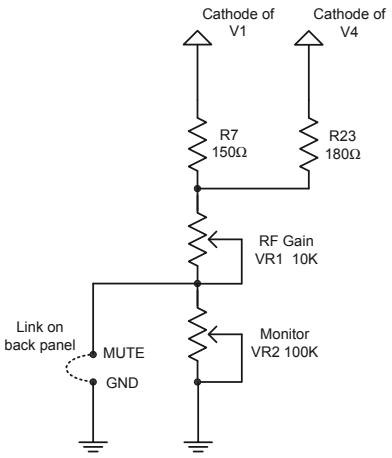

Fig. 3: RF gain and monitor circuit.

cies in red are those that are selectable or variable and those in black are fixed. I will explain the double-conversion receiver architecture by assuming we want to listen to SSB on the 80m band frequency of 3.6MHz and the receiver has been set to do exactly that. All the frequencies in Fig. 1 are given in Hertz – for those not familiar with changing units 3.6MHz = 3,600 kHz = 3,600,000Hz.

Basic Block Diagram

Any signal(s) with a carrier frequency of 3.6MHz impinging on the antenna is collected and passed through an RF amplifier so no frequency conversion takes place at this stage, just a strengthening of the received signal. There are some finer details such as a preselector that forms part of the amplifier.

The next circuit is the first mixer – the function of this device is to mix the incoming signal (f_{RF}) with a signal that comes from the first oscillator (f_{LO1}). This first oscillator is the VFO and is driven by the tuning knob on the front panel. This tuning knob also drives the dial that indicates the frequency you are listening to. For this example the VFO has been tuned to oscillate at a frequency of 8,773,900Hz. The output of the first mixer contains a number of different frequencies as a result of the mixing process but only one of those is selected by a filter – in this case it is always a frequency of 5,173,900 Hz. No matter what frequency you are tuned to, the wanted output of this first mixer will always be 5,173,900Hz – this is known as the first intermediate frequency (IF_1).

The signal IF_1 is then mixed in the second mixer with the signal from a crystal oscillator (f_{LO2}), which, being controlled by a crystal, always outputs a frequency of 5,628,900Hz. Again there is a filter on the output of the mixer so that only the frequency of 455,000Hz (the difference between the two frequencies being mixed) is selected and passed on to the IF amplifiers – this is known as the second intermediate frequency (IF_2).

The main function of the second IF amplifier (ignoring automatic gain control (AGC), which is discussed later) is to increase the signal strength of the second IF signal before it is passed to the demodulator to strip the audio off the 455kHz carrier. If you are listening to amplitude modulation (AM), then a simple diode detector is used but as we are listening to SSB, a third oscillator and mixer are required. The third mixer is called a product detector and the third oscillator is known as a beat frequency oscillator (BFO). The BFO can tune between 453 – 457kHz and is mixed against the 455kHz second IF

Fig. 4: Necessary link (orange wire)

resulting in only the audio remaining. This passes through an amplifier and on to the speaker. If the BFO frequency is 455kHz, then the output of the product detector will be the audio being received. For CW reception, tuning the BFO to 456kHz (for example) would mix with the CW carrier to produce a 1kHz audio tone.

Mixer Mathematics

We can now develop a simple equation to determine, knowing what frequency you want to receive, the frequency the VFO (f_{LO1}) must be tuned to and for the 80m band it is simply:

$$f_{LO1} = IF_1 + f_{RF}$$

This is called high-side conversion, that is to say, the VFO operates at a higher frequency than the received frequency. There is, however, one more complication to be revealed.

Table 1 shows in column 3, using the equation above, what the expected VFO tuning range should be to cover the band shown in column 2. Compare this to the actual tuning range of the VFO in column 4 and you notice that three bands (highlighted in gold) do not follow the equation above. This is because for these three bands the receiver designer used low-side conversion (the VFO operates at a lower frequency than the received frequency) where the equation changes to:

$$f_{LO1} = f_{RF} - IF_1.$$

Both equations are valid because they both result in the right value of IF_1 and the choice to do this switch between high-side and low-side conversion results in the engineer having to design an oscillator that only operates between 8.6 – 24MHz instead of the wider frequency range of 8.6 – 34MHz that would otherwise be the case. This knowledge is critical when it comes to the practicality of adding a frequency counter to the receiver.

A word about the band marked *Aux* on the BAND switch on the front panel. In the manual it appears that there was an

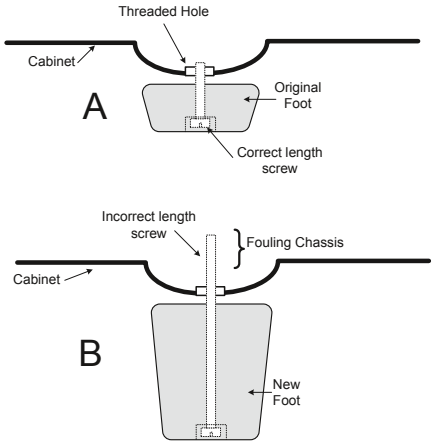

Fig. 5: Correct and incorrect screw length.

optional extra available to tune the time and frequency standard stations WWV and JJY by providing reception of the band 10.0 to 10.5MHz. In my particular FR-50B coverage of the band 1.2 – 1.7MHz is provided instead. This is the top end of the Medium Wave (MW) band and appears to be factory installed because the components used match the other VFO oscillator components. The preselector does not, however, cover this band so not unsurprisingly the it has no peaking effect on MW signals. Although the receiver has reduced sensitivity (because the preselector acts like a band-stop filter at these low frequencies) it is still possible to listen to broadcast stations after dark from all over Europe because these signals arrive with considerable field strength here in Ireland.

The second mixer mathematics has only one form and each term in the equation determining the frequency of the crystal oscillator (f_{LO2}) is a constant:

$f_{LO2} = IF_2 + IF_1$.

Receiver Selectivity

A receiver's selectivity is to what degree a receiver is able to focus on a wanted signal in the presence of other (possibly much stronger) unwanted signals. How close the wanted signal and an unwanted signal can be and how strong the unwanted signal can be relative to the wanted signal before the receiver treats them as one signal are defining parameters in modern receivers.

The selectivity characteristics of any receiver are determined by the filter(s) that are used and where in the receiver chain that filtering is done. The first filter that affects selectivity is usually a so-called roofing filter, which is placed as close to the antenna as possible, usually after the first mixer. This filter protects the following circuitry from non-linear operation that might occur due to strong out-of-band signals. In the FR-50B the first mixer is V2b and the second mixer is V3. Between V2b and V3 is only a peaking transformer called L6 – there is no roofing filter.

Band	Dial Markings (MHz)	Expected VFO (Hz)	Actual VFO (Hz)
80m	3.5 – 3.8	8 673 900 – 8 973 900	8 673 900 – 8 973 900
40m	7 – 7.5	12 173 900 – 12 673 900	12 173 900 – 12 673 900
20m	14 – 14.5	19 173900 – 19 673900	8 826 100 – 9 326 100
15m	21 – 21.5	26 173900 – 26 673900	15 826 100 – 16 326 100
10m	28 – 29.2	33 173900 – 34 373900	22 826 100 – 24 026 100
Aux	1.2 – 1.7	6 373 900 – 6 873 900	6 373 900 – 6 873 900

Table 1: Discrepancies in the mixer mathematics.

The principal filtering takes place after the second mixer, in our case at 455kHz, and this stage is responsible for the bulk of this receiver's selectivity. In a modern receiver we would expect to see a number of filters that are switched in or out of the signal path depending on what mode of operation (AM, CW or SSB) is being used. This allows the filter to be matched to the bandwidth of the wanted signal to cut out the maximum amount of unwanted signals and/or noise. In the FR-50B receiver the schematic shows only a single second IF filter called MF1.2, which is always in the signal path irrespective of the mode being used. There is no switching of filters.

The manual speaks of "*two 4kc mechanical filters*" providing a bandpass of ±5kHz measured at –50 dB and ±1.8kHz at –6 dB and these are marked by MF1.2 on the schematic diagram. These are not mechanical filters that appear in a long flat box or cylinder but rather look like two slightly larger TOKO coils mounted on a PCB, linked by a 400pF capacitor and mounted over a cut-out in the chassis. I measured the shape of the IF filter and this is shown in **Fig. 2**.

The performance of this filter is not great and combined with the lack of a roofing filter and selectable mode specific IF filters, explains the receiver's lack of selectivity.

The Missing Link

If you are using this receiver on its own, then there is a link on the back panel that needs to be in place to ensure correct operation. If you find that you need to set the MONITOR control to maximum in order for the RF GAIN control to have any effect, then the link is missing.

The FR-50B was made to be used with a matching transmitter and when operating the transmitter would mute the receiver. This receiver has a facility called MONITOR that allowed the user to hear their transmissions, useful when sending CW. Instead of completely muting the receiver, this system greatly reduces the RF gain of the receiver so that the receiver becomes very, very deaf but still adequate to demodulate the transmitter operating alongside. I have reproduced this part of the circuit, **Fig. 3**.

If you don't have the link in place, then VR2, which is ten times larger than VR1, dominates control of the RF gain. Now you can see why setting the MONITOR control to maximum, which cancels out must of the resistance of VR2, is needed to get the RF GAIN control to have any effect. Installing a link as shown in **Fig. 4** (orange wire) solves this problem.

Removing the Chassis

In order to remove the chassis, you need to remove the four screws on the underside of the cabinet – two at the front and two at the back. To be safe you should also remove the four feet before attempting to slide the chassis out of the cabinet. The original feet are mounted using screws that just enter the cabinet, which is dimpled to ensure the screw does not poke above the level of the cabinet – see **Fig. 5A**.

My experience with both receivers I owned is that at some point the owners removed the original feet (at least at the front) in order to put in much taller feet to raise the angle of the front panel for better viewing. This resulted in longer screws being required and those used in both my receivers stuck up far beyond the cabinet, preventing the chassis from sliding out because the screws at best caught on the front panel and at worst caught on components mounted under the chassis – see **Fig. 5B**.

In the next instalment I will look at replacing the electrolytic capacitors and curing the receiver's tendency to drift in frequency.

• E-mail: teleniuslowe@gmail.com

Don't forget – all reports to Steve by the 1st of each month please!

FT8, YOTA and More

Steve Telenius-Lowe PJ4DX has a packed column this month, with the onset of autumn bringing DXers and DXpeditioners out of their summer hibernation!

It's not often a new mode comes along that really captures amateurs' imagination. In the 1950s it was SSB and later Packet on VHF and PSK31 on HF. The *WSJT* suite of data mode programs by **Joe Taylor K1JT** is the most recent example. Initially developed as far back as 2000, WSJT was originally intended for VHF weak-signal modes such as meteor scatter and 'moonbounce'. But one WSJT program in particular was also adopted by HF operators: JT65. It allows signals below the noise floor to be decoded: important, as many amateurs' noise levels continue to grow. It has also meant that those running very low power, or with inefficient antennas, could make DX contacts for the first time. There is, however, one issue that dissuaded many HF operators from utilising JT65 – it is very slow, with the bare minimum of information exchange for a valid contact taking several minutes to complete.

Now, though, FT8 has been introduced in the latest WSJT release and its use has taken off astronomically. According to an ARRL press release on July 12th, FT8 offers sensitivity down to –20dB and contacts four times faster than JT65 or JT9. By that date, **Frank Donovan W3LPL** reported that A92AA, OY1DZ, TR8CA, VR2XMT, YE2IJ and YI3WHR had all been heard using the new mode.

Regular *HFH* contributor **Terry Martin M0CLH** is a keen advocate of WSJT and has been trying FT8. *"This month has been dominated by the exploration of the capabilities of the new FT8 data mode introduced by Joe Taylor in the latest (Beta) release of WSJT-X 1.8 rc1. This is available for all the usual platforms, the Mac version being utilised here. On first test, the preset frequencies disappeared but could be reset by selecting 'Frequencies' in 'Preferences' and 'CTRL' clicking in the window to bring up the 'Reset' option. This only needs to be done once. Some issues were discovered in the JT-Bridge software that communicates with the logging program RUMLogNG but these were swiftly resolved by the author,* ***Anders Östlund SM0THU****. All then went very smoothly.*

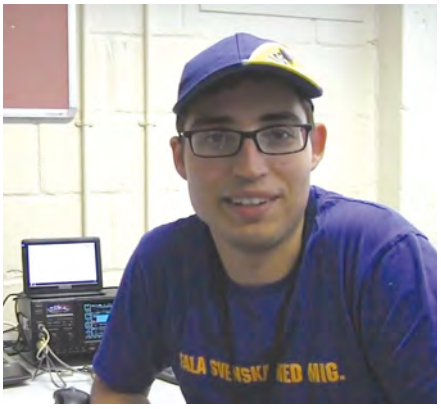

Fig. 1: Joshua DC7IA, one of the 40m SSB operators at GB17YOTA (photo from YOTA 'Daily Diary' on YouTube).

"Overall, the impression is that it is a very useful mode, albeit not as sensitive as the better-known JT modes. It is certainly getting very popular and it can sometimes be difficult to find a slot in the sub-band, which usually resides a couple of kilohertz below the JT modes.

"This new data sub-mode has now been recognised by the ADIF committee at the ARRL and an update has been made to the TQSL software so that it is recognised by LoTW [the ARRL's Logbook of the World]. *I hope that this new mode, which can complete a QSO in one minute, will be considered and adopted by DXpeditions in the future."*

Terry's log for August included more than 140 contacts made using FT8, some of which are in the band reports section. He concluded by saying, *"In summary, it is fast, furious, effective and most importantly, great fun!"*

YOTA 2017

Youngsters On The Air is an annual international event for radio amateurs below the age of 25 organised by IARU Region 1.

Fig. 2: Vertical antenna at the Europa Point Lighthouse, Gibraltar.

For one week in August, YOTA 2017 was held in the UK. 80 young radio amateurs from 26 countries enjoyed many aspects of amateur radio, making lots of new friends at the same time.

I made contacts with the YOTA special event station GB17YOTA on 20m and 40m SSB, **Fig. 1**, and the station notched up more than 10,300 SSB, CW and data mode contacts. Apart from HF activity, YOTA participants took part in Summits On The Air and ARDF (direction finding) events, made a contact with astronaut **Paolo Nespoli IZ0JPA** operating as NA1SS from the International Space Station, built a CW transceiver kit, took the UK Foundation licence examination and visited Bletchley Park and Ofcom (that's more varied activities than many accomplish in a lifetime of amateur radio!). A series of *Daily Diaries* were uploaded to *YouTube* by the RSGB and can be accessed via:

rsgb.org/yota-dd

I started in amateur radio when I was 13 years old and was licensed (originally as

G8FEO) when I was 16. I just wish there had been such programmes around in the 1960s and 70s when I was becoming interested in the hobby. Congratulations to all who helped bring this about, as well as to all the participants.

ILLW 2017

Following hot on the heels of YOTA 2017 came ILLW 2017 – the International Lighthouse and Lightship Weekend. Every year **Carl Gorse 2E0HPI** chooses two different lighthouses to operate from. He wrote that this year, *"The first lighthouse was Seaham North Breakwater Lighthouse (UK-0210) and I set up with my tarp to get out of the wind."* He worked no fewer than eight GB special event stations, all operating from lighthouses, on 40m SSB. *"The second lighthouse was South Gare Lighthouse (UK-0211), which took a good while getting to by public transport then a four mile walk along the beach. I arrived a little later than planned but still spent two hours operating, again only on 40m SSB, before walking back."*

ZB2LGT at Europa Point Lighthouse (GI-0001, **Fig. 2**) was activated by Gibraltar Amateur Radio Society members **John King ZB2JK**, **Robert Morgan ZB2TT**, **Ronald Pincho ZB2B**, **SWLs Steve** and **Andy**, and **Kevin Hewitt ZB2GI**, who wrote to tell us about the event. *"The station comprised a Yaesu FT-450 running into 5m of wire wound on to a 9m telescopic fishing rod connected via a 9:1 balun. We also used a 15m sloping wire connected via a 9:1 balun and an inverted-V dipole for 6m. Initially transmitting at 50W running from batteries, this was increased to 100W when mains power became available. The station operated on 60, 40, 30, 20, 17, 15, 12 and 10m plus 6m. Despite poor band conditions the log included around 700 SSB, 100 CW and 50 FT8 contacts. The majority of contacts were made on 20m into Europe, with the States calling in for the last hour before the station closed down for the night."*

Mike Patterson VK4MIK wrote to tell readers about the ILLW operation by the **Tableland Radio Group, VK4GHL** in Tropical Far North Queensland. It was the 13th consecutive year they operated from Grassy Hill Light (AU-0019) in Cooktown. The light was constructed in 1885 and is still in operation. Mike was joined by group members **Ross VK4AQ** and wife **Bev**, **Dave VK4FUY**, **Pat VK4MUY** and **Jamie VK2YCJ**, who drove up from near Newcastle for the second year, a distance of over 3000km! Mike wrote, *"We set up our inverted-V antenna atop the 15m portable mast and used poles over a council concrete table and a tarp over it for our operating position. An FT-897D and MFJ-948 ATU connected to a 100Ah GRM battery with an 80W solar charger composed the operating equipment... We made contact with 16 ILLW stations in Australia and New Zealand, including the VK8GM team at the Todd River Lighthouse at Alice Springs in central Australia. They were in very good spirits and justly proud of their lighthouse, as they should be."* Mike concluded by saying, *"It's this co-operative spirit and obvious pride in the lights selected by the various groups as well as the opportunity to set up and operate as a portable station along with its social nature makes this event unique... The efforts of the organisers are much appreciated for its ongoing success."*

Fig. 4: The set-up of OS8D/M, in this case operating from Luxembourg.

November DX

Other than during contests and international events such as the ILLW weekend, the HF bands all seem to have been very 'flat' for several months now. One reason for this is that there have been very few DXpeditions since the successful British A25UK operation from Botswana in April. I was therefore pleased to read of plans by the Italian DXpedition Team to activate Bubaque Island (IOTA AF-020) in Guinea-Bissau, West Africa, between November 13th and 25th. J5T, **Fig. 3**, will be operated by seven Italian amateurs plus Japanese operator **Mac JA3USA** on CW, SSB and RTTY, using four stations to beam antennas on the higher bands and vertical arrays on the low bands.

Fig. 3: Look for J5T from Bubaque Island between November 13th and 25th.

Guinea-Bissau is an easy path from the UK and the Italian DXpedition Team has a good record, having made over 63,000 contacts as TL8TT (Central African Republic) last February and more than 91,000 from 3XY1T (Guinea) in 2016. It should therefore be fairly easy – even for those with 'modest' stations – to work J5T, particularly after a few days when the initial pile-ups have died down somewhat.

The Italian DXpedition Team has developed an (almost) real-time online log check so that you can ensure your callsign was received and, just as importantly, logged correctly within a minute or so of making the contact – pretty impressive considering the remote locations of their DXpeditions. Full details of the J5T operation as well as the team's previous DXpeditions can be found at:

www.i2ysb.com/idt

I will be looking for J5T on all bands and on both SSB (my preferred mode) and CW. That's because although I have worked Guinea-Bissau several times since becoming active as PJ4DX in December 2013, I don't yet have it confirmed on LoTW. Some have criticised the Italian DXpedition

Fig. 5: Carl 2E0HPI operating Pedestrian Mobile.

Fig. 6: Vintage 1980s-era QSL card from LG5LG. The station is still going strong!

Team for not uploading their logs to LoTW straight after the DXpedition – they usually do so six months later – but, for me, DXing is a long-term activity with the eventual goal of DXCC Honor Roll. I am therefore quite content to wait until the logs do eventually appear on LoTW.

The other major DXpedition announced for November is VK9MA, which is scheduled to be active from Mellish Reef in the Coral Sea (east of Australia) between November 3rd and 16th. From the UK, this will be a more difficult target than J5T but the team plans to run four high-power stations 24 hours a day and is taking a very impressive array of antennas. As is well known, vertical antennas work especially well when located very close to salt water, and four-square arrays in particular can produce some outstanding results when by the sea, so don't be surprised if you hear some big signals from VK9MA. I would suggest that 20, 30 and – because of the planned four-square array – even 40m should be the best bands from the UK.
https://vk9ma.com

Readers' News

Etienne Vrebos OS8D (Brussels) wrote with the sad news that his good friend **Jean Lewuillon 5T0JL** passed away on August 8th in his 88th year. A fellow Belgian, Jean was a *"99.9% CW operator"* who gave many DXers their first contact with Mauritania. Meanwhile, Etienne was busy operating as F/OS8D/M from his car in northern France. He used 100W from a Kenwood TS-480 to a short vertical on the car roof to *"make some nice QSOs all over Europe on 20m"*. The previous week he did the same as LX/OS8D/M, **Fig. 4**, from Luxembourg, 550m ASL, and worked as far as RW9HSB in Siberia. During the month he was also active from Germany as well as finding time to make some good QSOs from home – see the band reports.

Carl 2E0HPI (Hartlepool) has been operating Pedestrian Mobile on the beach with an Elecraft KX2 transceiver running 5W to an MFJ-1820T whip antenna with a trailing counterpoise wire, **Fig. 5**. Carl says, *"It works really well by the water and on 20m SSB I worked OH3OJ/P, YO2MPL, OM6DN, EI66WAW and OH3GZ. I even heard a VK3 via the short path but the pile-up was too big to get in. But nice to listen to!"* Carl concludes by saying, *"I do like to have a challenge with these small antennas and most of all to have fun."*

Realising that he had only 15 days at home in August, **Victor Brand G3JNB** (Shefford) got busy and opened up his log on 30m CW with HI3A, FY5FY, CU8AS, C31CT and ZD7BG on St Helena. He reports that working OA1F in Peru on the 17m low-angle vertical is usually relatively straightforward but on 20m, with 50W to his doublet, it was a challenge. *"Carlos was literally besieged by heavy duty EU and W stations and all I could hear through the roar was just the occasional 'G3?' Suddenly, after half an hour, it was as though everyone paused to draw a breath. Total silence! I rapped out my call and back came 'G3JNB 599'. Resumption of roar. Job done!"* From Aruba, P4/DL4HG on 20m was no problem for Victor, despite fading (QSB). However, due to heavy ice conditions in the East Siberian Sea, RI0LI, the Russian Robinson Team DXpedition to the Bear Islands, had been delayed for a fortnight and demand from the pile-ups was phenomenal. Getting through to them on Leont'yeva Island proved to be tricky but, yet again, a very brief silence let Victor slip past the callers. Victor noted that despite the rise of the solar flux index (SFI) to 80 from earlier lows of 69/70, the DX opportunities did not seem to deliver his hoped-for improvements to the long distance paths.

In addition to operating from the Europa Point Lighthouse during ILLW as reported above, Kevin ZB2GI (Gibraltar) lists his highlights for the month as making his first SSB contact on 60m – and with a new DXCC too: S01WS, the Sahrawi Amateur Radio Club in Western Sahara – and working GB5RC on board the Radio Caroline ship, the *Ross Revenge*, anchored in the Blackwater estuary near Bradwell-on-Sea in Essex. GB5RC was commemorating five decades of offshore radio. Kevin wrote that, *"Plans to operate Maritime Mobile with John King ZB2JK changed when the*

seas became choppy and a mist started rolling in on the horizon once out in the Bay. Back on dry land we operated from Sandy Bay on the east side of the Rock for 30 minutes."

Owen Williams G0PHY (Biggleswade) reported that, *"There was even less activity this month than in July. I was away for two weeks and conditions seemed to be poor when I did listen, although I heard stations in South America, Africa, the Caribbean and North America. I had two interesting contacts. The first with LG5LG,* **Fig. 6***, at a place called Morokulien on the Norwegian/Swedish border that also has the Swedish callsign SJ9WL. The second was with TZ4PR, in northern Mali, actually in the middle of nowhere if his QRZ.com page is to be believed. As usual, all contacts on SSB to dipoles with power between 100 and 200W."* In the 1980s I lived in Sweden and stayed at Morokulien on several occasions. The house, which sits right on the Swedish-Norwegian border, can accommodate up to five people and is available to rent to visiting amateurs for the bargain price of around £30 per night. Included in the price is the use of the well-equipped shack and HF and VHF antennas on a 32m high tower. For further details see either of these websites:

www.qrz.com/db/lg5lg
www.qrz.com/db/sj9wl

Band Reports

Etienne OS8D managed to find some good DX, despite the distinctly average conditions, using his Icom IC-7851, Acom 1010 500W amplifier, new Hexbeam antenna just 6m high and a 4-band end-fed long wire. 40m SSB: YB72RI/1. 20m SSB: 3A2NL, 4L0GF, 4O/ON5JE, 5T2AI, A25JK, EY7AD, FR5EC, GJ4PVM, HB0/EA5ELT, HC5DX, HS7BHK, JH5MXB, OH0/DL1FMK, OH0/OF5C, OY/RU7D, PY2NFT, TY2BP, UA0LSG, V51WW, WA0HHX, YB72RI/8, ZB2BU. 17m SSB: HB0/EA5ELT, OD5VB, TR8CA, VP2ETE. 15m SSB: CX2DK, FR4QT, HB0/EA5ELT. 10m SSB: OY1OF.

As noted above, Terry M0CLH has been very active on the new FT8 mode. His best contacts for the month included, on 40m SSB: ON9BD. 40m FT8: HB9IAT. 30m JT65: HS0ZIV. 30m FT8: SV5KKU. 20m SSB: EG1LWV. 20m CW: 5B4AMX, JT5DX, LZ55UPB. 20m RTTY: TC102GS. 20m JT9: KB3MP, RW0SR. 20m JT65: C31MF, W6NWS, YC2YIZ. 20m FT8: 4X4MF, 9H1KR, AE1T, CU8FN, EA8CNR, EK6RSC, JY5IB, K1HTV, K4EGA, KB1WEA, LU5DT, NC2V, OX3LX, SV5BYP, SV8LMM, UA9WV, VE3BXP, VE3RSP, WA8QYJ, WS9V, WW-1WW, YB7GRN. 17m SSB: 5B4AIX/P. 17m CW: OH0/OF5C. 17m FT8: AA7A, EA6BH, EA8RY, JA2ATE, K4PI, N1UK, N1UZ, T77C, TR8CA. 15m JT65: ZS4GB. 15m FT8: IS0DCR. 12m FT8: GI4SNA. 10m SSB: LZ55UPB, 10m FT8: IS0DCR, MW0LGE, OE2RPL, OM7ASP, YT5DLT.

As usual Kevin ZB2GI has been out and about, operating Portable from the top of the Rock of Gibraltar, 412m ASL, Sandy Bay at sea level and from his home. 60m SSB: S01WS. 40m SSB: GB5RC. 20m SSB: 5B4VL, E72A, GB5RC, GJ4PVM, K8YSE, PA2A/P (PAFF-0015).

Signing Off

Thanks to all contributors. Please send all input for this column to **teleniuslowe@gmail.com** by the 1st of the month (November 1st for the January 2018 issue, December 1st for the February magazine). 73, Steve PJ4DX.

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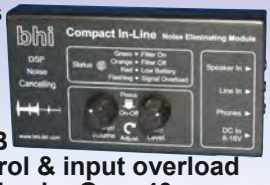

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Dinghies and Spies

Ben Nock G4BXD reports on two recent acquisitions, a dinghy radio and a Russian set reputed to have been used by spies during the Cold War.

A very warm welcome to my Valve & Vintage column coming to you once again from the Military Wireless Museum here in Kidderminster. As I write this column some time in advance I never know just what I will find out there but the search goes on for new additions for the collection. Some changes to the layout has freed up a good space on the operating bench so you should be hearing a bigger selection of sets being tested from the GB0MWM callsign this year.

Dinghy Transmitter

While surfing the web a while back I saw this little item being offered, an Air-Sea Rescue Dinghy Transmitter Type T.3180 (Walter Mk.1). An unusual item, this. It was one of the first VHF beacons designed specifically to be deployed in an inflatable life raft by aircrew that had to ditch in the sea. It operates on the same frequency, 177MHz, as the early airborne radar systems such as the ASV MkII and could therefore be picked up by such equipment in other aircraft.

The unit being offered was missing the battery tube and extending mast. Amazingly, as if by some preordained act of fate, I spotted another sale item a few days latter that turned out to be the extending mast complete with its folding dipole top section. Of course, I snapped this up, **Fig. 1**, leaving me with just the battery tube to replicate.

The T.3180 transmitter was a compact portable homing transmitter, **Fig. 2**, designed to help locate downed airmen. It is fitted with a telescopic antenna support mast and an integral dry-cell battery power supply. The transmitter emitted a pulsed signal that could be received over a range of up to 20 nautical miles by the airborne ASV MkII radar sets or Rebecca MkIIb equipment, as fitted in Coastal Command and Fleet Air Arm aircraft at that time.

In Use

In use the telescopic mast, **Fig. 3**, extends to a height of approximately 1.83m and was supplied with three guy ropes attached to the mast and which could be secured to the K-type dinghy sides. The lower section of the unit would have been held between the airman's knees and there was a felt pad fitted to the base of the battery and mast in order to prevent slipping and damage to the dinghy floor. To conserve the battery it was recommended that the transmitter be operated for a five-minute period at 15-minute intervals and then only intermittently or until an aircraft or rescue craft was sighted.

The single valve transmitter, a CV93 miniature wire-ended triode, operated on 177MHz plus or minus 1MHz with a pulse repetition rate of 25 to 60kHz. The batteries were housed in a round sealed tube, a 90V and a 1.5V type, with the transmitter drawing 70 to 100mW of HT power and 180mW of LT power.

The battery tube, the mast and transmitter base are bolted or clamped to each other and, in use, the mast is extended and the transmitter head, holding the pop-up dipole antenna, is raised at the same time. The base part stays fixed to the battery tube and a spool of wires, held in the base and supplying the voltages to the transmitter, pays out as the mast is extended.

While researching the unit, I found the following account (website below) of the set in use: *"Splashdown in the Mediterranean of Hastings TG613. Walter T.3180 – two of these transmitters were salvaged. Seawater had leaked through the seal with the result that the batteries were wet. The one set was erected and turned on when the search aircraft was heard.*

"Unfortunately, the Albatross did not carry search radar and therefore the value of the equipment could not be assessed. Some difficulty was experienced in mounting the aerial as the steady lines to the dinghy sides from the mast were too short with the result that one line had to be held by one of the survivors to keep the mast erect".

http://splashdown2.tripod.com/id14.html

The original battery tube was made from Tufnol-type composite material, with fibres glued under pressure. I had none of that around but the diameter of the tube was

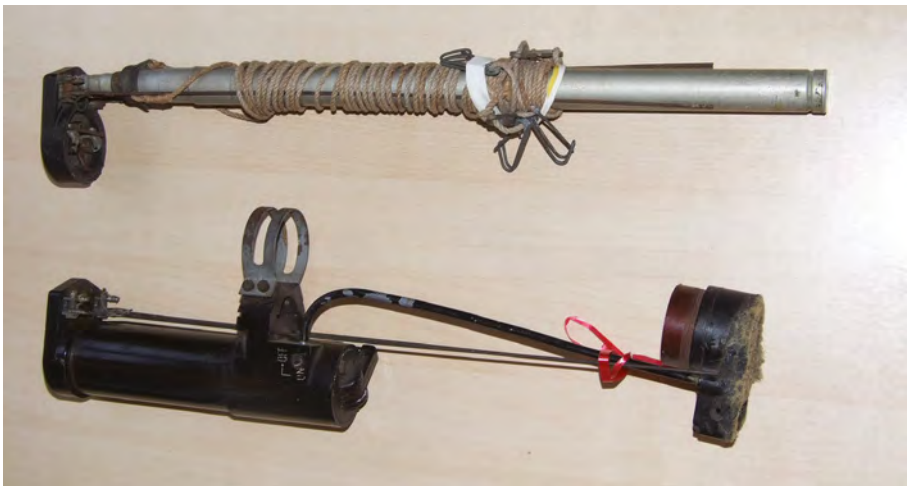


Fig. 1: The two bought items

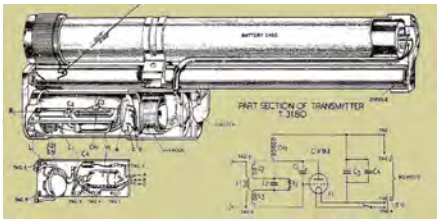


Fig. 2: An original manual drawing

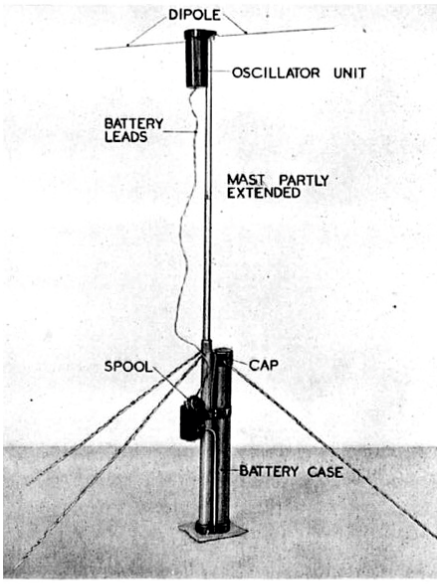


Fig. 3.—Mast partly extended

Fig. 3: The mast partly extended

1.5in and this is the size of standard waste-water pipe for domestic sinks and the like. This I had and after cutting to length, painting, fitting and finishing off with an end cap milled out of PTFE by my good magician friend **Wayne** (yes, he really is a magician), the result, **Fig. 4**, is quite acceptable I feel.

Russian Spy Radio

One set I have been after for quite some time is a rather cute little Russian thing used by their Special Forces and maybe, just maybe, their spies as well. By the good fortune of my German 'agent' **Johannes Gerken DL9QQ**, who spotted one being offered for sale near to him and acquired it for me, I was able to fill the gap in the collection.

The innocuously named R-354 (P-354), **Fig. 5**, is probably the most widespread 'spy radio' deployed by the former Soviet Union, or USSR, during the Cold War period. It was apparently introduced in the mid-1960s as the successor to the previous model R-350 and the R-350M and saw service in most of the countries of the former Warsaw Pact or Communist Bloc, such as Poland, the old DDR and the then Czechoslovakia.

Use by agents is in doubt if you scan the web but they were certainly used by Russia's Special Forces. The set is also known by its military codename 'Shmel', or Bumblebee in Russian. In the late 1960s it was succeeded by the R-353 model. The radio uses a combination of semiconductors and miniature valves, tunes 2.5 to 15MHz and weighs around 15kg.

Fig. 4: The competed restoration

Fig. 5: The R-354 transceiver

Description

The fully self-contained radio is powered from a 6V battery that is actually stored inside the top lid. A short cable on the front panel connects the radio to this battery, giving the operator just 15 minutes of power for reception or transmission. Once the battery is exhausted, it can be recharged with a hand-operated power generator that was supplied with the set along with various other items, antenna wire, short poles, ground leads and so on.

In addition to the self-contained battery, the set could, of course, be powered from any 6V supply, the standard car battery of the time. An extension power cable was carried in the haversack bag that held the set, antenna wire, leads and various bits.

The set has two frequency displays, one for receive frequency and one for transmit frequency. These are projection-type displays – the light shines from inside the set through a film and is viewed from the front. To aid tuning in high light levels, a small hood was carried in the haversack, which when fitted to the front made reading the scales much easier.

Basically the set is in four sections, the receiver to the left, then the transmitter, then the antenna tuning section followed by the Burst Encoder, **Fig. 6**, on the right. One cunning feature was the use of 35mm film, available worldwide. This was first

Fig. 6: The keypad and manual Morse key above.

passed through a slicer, cutting it into two 17.5mm strips. The film is then fed through a puncher and a pen is used to enter the digits of a pre-coded message on the rotating disc, much like dialling a number on an old rotary telephone.

Each number is represented by a series of holes in the film. After inserting it into the coder, a light source senses the holes in the film and transmits the groups of numbers with a speed of 1125 numbers per minute.

The supplied headphones, which are also housed in the lid when not in use, can be connected to a two-pin socket on the left of the unit. A small light bulb on a flexible gooseneck arm is provided, just to the left of the keypad, which comes on when it is released from its holder, to allow the built-in burst transmitter to be operated in the dark.

A later modification to the radio by the Czech firm Tesla replaced the scale displays with LED displays, making the set very attractive to operate. To conserve battery life, these displays were only lit when either the receiver or transmitter net buttons were pressed.

Considering the use of a 6V battery to be rather inconvenient, I fitted a small regulator PCB in the battery space in the lid that converts 12V down to 6V to make the radio slightly easier to operate today. Although I have tried the set on the workbench into a dummy load, I have not had it on the air yet. So, do listen out for a rather strange sounding or rather fast CW from the museum in the near future.

And Finally

That's it for this outing in the *V&V* shop. I trust the sets have been of interest and, of course, there are plenty more pictures to view on the museum's website, below. For those interested in visiting, the museum would be happy to see you. Visits are by prior arrangement and contact details are on the website so do get in touch. Cheerio.

www.militarywirelessmuseum.co.uk

• E-mail: geofftheasby@gmail.com

Review – Function Generator Kit & 500MHz Counter Module

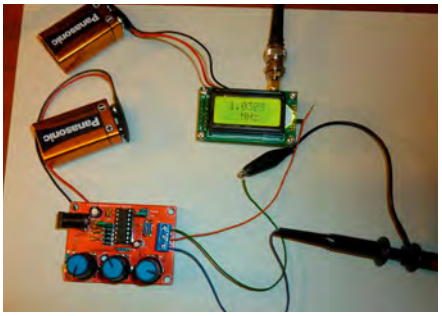
Geoff Theasby G8BMI has another review of a cheap but useful kit and a handy module.

This occasional series is intended to provide a review of the many low-cost kits and ready-built modules that are available on line, mostly under £10 at UK April 2017 prices. Delivery may take a month.

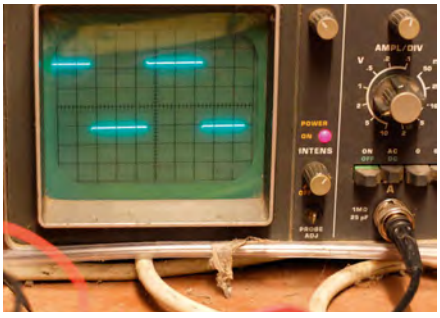
Following up our esteemed Editor, **Don's** request for kit reviews in his November 2016 *Keylines*, I wrote up a 50MHz frequency meter kit (July 2017 *PW*) and in researching the article, I discovered several cheap kits and ready-built modules that readers may find useful. I realise that a built module isn't so much fun as a project you built yourself but at the prices quoted, collecting the components individually would be much more expensive or difficult, particularly the PCB. It may also be the case that these are 'end-of-line production', or obsolete components and when they're gone, they're gone! No doubt others will come along later.

I dealt with two main suppliers, Amazon and eBay, which in my experience are trustworthy to deal with, safeguard private details and have a formal complaints procedure. Other suppliers may be similar but I haven't been trading with them enough to form an opinion. In any case, neither *PW* nor the author can accept any responsibility for any subsequent difficulties. Caveat emptor!

I propose a series of brief reviews, dealing with one kit and one built module per article. There are usually several suppliers and even some counterfeit products, notably of JYE Tech kits. Not all kits are supplied with circuits or instructions but the information is usually to be found elsewhere on the internet. Search engines are a great help. One kit was particularly difficult to track down. I spent about half a day looking but was ultimately successful. If a search by the kit reference number reveals nothing, try under the main active device and its *Application Notes*. Failing that, a reference number is often marked on the PCB, which leads to further information. I have built or bought every kit and module reviewed and to date every one has worked first time, or straight out of the box.



Function generator & counter.



Function generator square wave.

This Month's Items

This month I am looking at a function generator kit and a 500MHz frequency counter module. You will find these units or something similar by doing a search on one of those auction sites I mentioned. *(A check just before publication showed two or three similar, if not identical units. Indeed, I saw the XR2206 function generator, rated at up to 1MHz, on the UK eBay site for just £6.09, including postage. Ridiculous! The cheapest 500MHz frequency counter I could find was rather more expensive than Geoff mentions – a whole £8.99! – **ed**.)*

Function Generator

I built the Function Generator, which offers sine, square and triangular waveforms up to 2MHz, in about one hour, with another hour setting up for photography, testing and evaluation. It runs from a 9-12V battery or PSU, consuming 15 mA. Waveforms were checked against my Thurlby Thandar TG102, 2MHz Function Generator and Philips PM 3226, 15MHz oscilloscope and are very well shaped. The PCB measures 60 x 45mm and smart, matching control knobs are included, as is a snap-together Perspex case. The oscilloscope couldn't show the square-wave rise time, it was too fast, with no sign of overshoot, rounding or ringing, and the frequency meter showed that my example at least operated up to 2MHz. It cost £7 and came with a circuit diagram but the instructions are in a sort of strangulated English, which mostly make sense, if quaint. Do not be alarmed by reference to welding – they mean soldering! Criticism, though, is easy. I would have no chance of rendering such details into Chinese! A list of components and a PCB layout diagram is provided. At its heart is the familiar, dedicated XR2206 IC, and the precut transparent Perspex case, which is covered with a sort of brown material, assembles easily and allows access for changing the waveform shape and frequency range, using pin jumpers.

Frequency Counter

The 500MHz frequency meter module was £8 and has an LCD backlit display in soft green, measuring 60 x 35 x 30mm high, two boards stacked together. An on/off switch and 9V battery snap connector are included. Current consumption was 50mA. Input is via an SMA socket and a small bench signal generator was detected with the frequency counter alongside it using 100mm of wire as an antenna. A Baofeng UHF magmount antenna and SMA coaxial adaptor was similar, when testing with the 50MHz oscillator/crystal tester and an HC6-U crystal for 8.092MHz. Yes, I know the antenna and crystal frequencies, like galaxies, are far, far apart, but that's what was to hand!

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New Release of FT8

Tim Kirby G4VXE reflects on how the FT8 mode is taking the VHF world by storm and has all the usual operating news.

If you have been reading the amateur radio press over the summer, you can't fail to have seen all the news about the new FT8 mode that has been added to the WSJT-X software written by Joe Taylor K1JT. It's probably no exaggeration to say that FT8 has taken the amateur radio world by storm, creating lots of interest.

I have been using it for the last couple of months on 50MHz in particular and have really enjoyed it. Compared to JT65A, although a little less sensitive, it's up to four times quicker to make a QSO, which, of course, is really useful in rapidly changing conditions like an Es opening.

The great news is that a new version of the WSJT-X software has been released (RC2) which builds on the success of RC1 and has improved the performance of FT8. As soon as I saw the new version was available, I installed it (backing up the old version – just in case!). What was immediately noticeable on 50MHz over the first day or two of using the new version was that I was decoding UK stations that I hadn't seen before on FT8. Of course, that could be for several reasons – perhaps they hadn't been operating before, or conditions were better for groundwave. But, actually, I knew they had been active because I'd seen people working them and I just hadn't been able to copy them. It was quickly apparent that the new version of WSJT-X was decoding weaker FT8 signals than the previous version. This was great! I quickly started calling a few UK stations who I'd previously tried to work on FT8 but hadn't been able to get them to hear me and now had some good success.

Another interesting feature of the new release was that I noticed that unlike the RC1 version, RC2 was much less tolerant of aircraft scatter/Doppler shift of signals. Whereas RC1 was quite tolerant of aircraft scatter (especially compared to JT65A) on a path, RC2 would quite often fail to decode. This probably comes as no real surprise and is a small price to pay for the greater sensitivity of the new release.

There are some other useful features in the RC2 software. Say, for example, you are calling someone and they go back to someone else, the new release detects that and disables your transmitter so that you are not causing interference to the QSO. As someone that makes a lot of remote contacts, I found this was particularly reassuring because my one worry up to that point was that I would start to call someone, lose my connection to the shack and my transmitter would be left sending until the runaway-transmit timer kicked in or I could persuade someone at home to disable the transmitter. The runaway-transmit timer would kick in after a short period, so there is no major problem, but it was something I was conscious of. This new feature does keep interference down and will, hopefully, make it easier to make contacts.

If you haven't upgraded to RC2 yet, do – it's a simple process and described in detail in this month's *Data Modes* column.

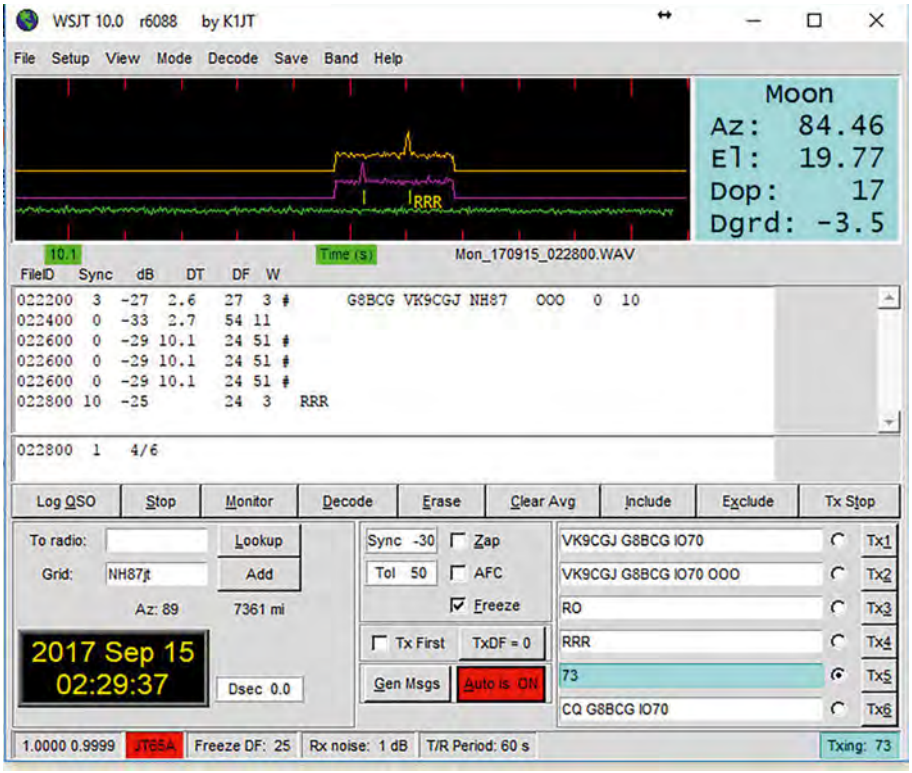
Of course, in a rapidly changing environment, it's possible that by the time you read this, there may be yet another new version. If there is, install that. The important thing is to keep an eye on the page for new releases and to try them out.

The only slight wrinkle that I discovered, having installed the new version, is that I had to reset all the default frequencies for the different modes because the software had lost them. Just do File/Settings and select the Frequencies tab. Right mouse click in the table of frequencies and select Reset. Press OK to save and then exit the program and restart and you should find that all is working as it was before.

Station Update from G8ECI

It was good to hear from **Derek Brown G8ECI** (Lincolnshire) who is in the middle of refurbishing his setup. He writes, "*I am in the process of reinstalling my 42ft Westower, which has been lying on the ground outside the shack door since mid-2001. Needless to say, the years and weather have taken their toll but luckily not to the tower structure. That's still in great shape, apart from a bit of surface rust. The original hot-dip galvanising has*

Europa Point lighthouse, Gibraltar, location for the ZB2LGT activity.



A screenshot of Peter G8BCG's 50MHz EME contact with the VK9CGJ expedition.

done its job over the years. Not so much, though, for the HyGain T2X rotator, after 16 years of sitting inside the tower top, either in a damp shed or out in the open. I removed it and gingerly took it apart to be greeted with a fair amount of corrosion. I'm currently awaiting various parts from The Rotor Doc in Kentucky USA but hopefully should have it all back working again soon. The top half, which has the motor and reduction gears, was saved the ravages of the condensation and corrosion so these parts just needed a good cleaning and re-lubricating.

"I will have 6m, 4m and 2m on this tower, which will be at the end of 80ft of feeder. I should have enough LDF4-50 for 144MHz but am not sure for 4m or 6m. I should be reinstalling my 12-element M2, which has also been lying out in all weathers for the same 16 years so that may need some work as well first. Once I get that project completed, I have plans for upgrading the 70cm, 23cm and 13cm systems on a shorter pole, 20ft high but right next to the shack. I have two new Wimo Antennas for 70 and 23cm and have been donated a 1.2m prime focus dish for 13cm. The 23cm linear (a 1980s EME 2 x 2C39A PA) is being refurbished and that with the 54143 preamps for which I now have the changeover sorted and am no longer blowing them up! I will get the old LMW 13cm transverter out and see what I can do with 500mW into a pea-can feed and the dish. So, it should be a busy autumn!"

The 6m Band

The first person to get his band reports in each month is always **Josef Van Raepenbusch ON8NT** (Aalter). Jef runs 10W to a V2000 vertical on the 6m (50MHz) band and always make some noteworthy contacts. Some of Jef's most interesting contacts came during the Italian contest on August 27th, when he worked among others: IS0BSR (JM49), IT9BLY (JM78), IT9BDM (JM77), IZ7VPK (JN80) and IZ8JAI (JM78).

Kevin Hewitt ZB2GI wrote with news of the Gibraltar club's 50MHz activity during the International Lighthouse weekend when they operated as ZB2LGT from Europa Point lighthouse. He and **John King ZB2JK** set up an inverted-V dipole for the band with an FT-450 running 50W. They made 28 contacts on SSB during a 40 minute opening with contacts into F, S5, I, EA, DL, 9A, ON, HB9, G and PA. They also tried some FT8, running 10W into the same dipole, and worked PA and EA.

As ZB2GI, Kevin operated on FT8, using 10W into a dipole. He worked G8BCG (IO70), G0LFF (IO90), G3VIR (JO01) and G3LDI (JO02).

Mark Marment CT1FJC (Algarve) has made a good number of FT8 contacts with the highlights being GD0TEP (IO74), GM4JJJ (IO86), EI4KN (IO52), IT9/IK4RSR (JM78), 3A2MW (JN33), HB0WR (JN47) and EI7HBB (IO53).

Phil Oakley G0BVD (Great Torrington, Devon) has also been trying out FT8 and enjoyed working some new squares. Some of the highlights of Phil's log were EA8AQV, EI3KD and LA7DHA. During the big aurora on September 8th, Phil worked G7GLT and EI5CE on the band.

Peter Taylor G8BCG (Liskeard, Cornwall) says that he hasn't been too active following the failure of his main tower back in June but reports that the level of activity on the new FT8 mode has been amazing, although he feels that it has taken activity away from other, as he says, often more suitable modes. Peter has worked 103 DXCC entities this year so far with only a single 8-element Yagi from June to September. Peter's tower is now back in action and he has just taken delivery of a larger H-frame from InnovAntennas to optimise his 4 x 8-ele OP-DES array spacing. Peter was very keen not to miss the VK9CGJ expedition from Cocos Keeling Island so he put together a temporary 4 x 8 element array and pointed it at moonrise with a slight amount of elevation. Peter's hard work paid off and he was able to complete a contact successfully. After two days, VK9CGJ has made 49 successful EME QSOs on the 6m band – another excellent expedition by **Lance W7GJ**. Once Lance had finished operating from VK9CGJ, the plan was to do it all again from VK9XGJ (Christmas Island)!

Here at **G4VXE** I was active on FT8 most days although conditions and activity seemed to tail off during the latter half of August but there were still some interesting QSOs to be had. Highlights were CT2IUV/P (IM59), T77C and several LA stations in northern Norway on August 30th as well as GD0TEP who was an enormous signal on September 12th. I was particularly pleased to reach 200 squares confirmed on the band via Logbook of the World during the month, all using nothing more than the vertical antenna. As I mentioned earlier, I operate remotely for the majority of time and even enjoyed making some QSOs during my commuting time from the train. It's just a simple matter of using remote control software on the shack PC and an app on my smartphone, which allows me to connect. As long as the internet

connection is reasonable, it works very well, especially with the very automated nature of FT8 QSOs.

The 2m Band

Jef ON8NT made some contacts during the 2m (144MHz) contest on August 1st, with the highlights being G4CLA (IO92) at 355km and G4CZP/P (IO90) at 332km. During the Perseids meteor shower, Jef monitored the MSK144 frequency to see what reflections he could hear but didn't see any completed QSOs, just fragments, including reports. Jef runs at FT-736 at 25W to a 5-element log periodic.

My apologies to **Graham Jones G3VKV** (Cheltenham) whose name we managed to get wrong in the October issue – sorry Graham! Graham managed to work GM0HTT (Orkney) during the big aurora on September 8th.

David Smith G0OSA writes to say that he spent a couple of hours on air on the Sunday morning during the September 144MHz Trophy Contest. He was very pleased with conditions and made his first 2m contacts into France: F6KCZ/P and F5LJA. David was running 50W from his FT-857D into an Elk 2m/70cm log periodic antenna from a portable location near Huddersfield.

Phil G0BVD heard GM6RBR (IO77) and EI6JK (IO53) during the aurora on September 8th but was unable to work them.

Simon Evans G6AHX (Twyning, Gloucestershire) took part in the September 144MHz Trophy Contest and worked 50 stations, with his best DX being F8KID in JN38 at a distance of 680km. Simon also took part in the 144MHz UK Activity Contest on September 5th, when his best DX was PA5Y at a distance of 455km. Simon mentions that he heard the ED1ZAG beacon on 144.403MHz on occasions but despite many calls in that direction, he wasn't able to make any contacts. This propagation was at the same time that other stations were working into EA8 but Simon says he heard nothing at his location.

Lyn Leach GW8JLY (Cardiff) writes with his usual interesting and comprehensive report on the band. "*Once again, the Perseids meteor shower in mid-August was not as good as the year before. This decline has been a continuing theme now for the last few years and this poor performance was especially disappointing because some had predicted that we would see an exceptional Perseids shower this year. I did manage to work a new locator though, in a QSO with SN5R (KO01) on August 12th. I was also pleased to work EI/ON5GS in IO54 on August 10th. Dirk was operating from IO54 on meteor scatter but kindly switched to JT65 to give me the locator on tropo.*

"A tropo opening to the Canary Isles (EA8) during the evening of September 6th gave me another opportunity to make a QSO with EA8. I worked ***Fernando EA8TX*** *(IL18) once again. This was the third time in three months that tropo to the Canaries was available here in South Wales. This is quite exceptional for me because these opportunities usually occur only every few years at my QTH.*

"A significant aurora occurred on September 8th. This had been predicted by many and was even mentioned in our national news. Unfortunately, I can only operate on SSB because I have never quite mastered CW. As always, the real DX was only available on CW and I missed some of the amazing opportunities to work stations at very great distances in this event. Working stations using SSB in an Auroral event is never easy but I was able to complete 27 QSOs with stations in GM, EI, G, LX, ON, PA and DL. The farthest QSO was with DL8YAU (JO41) at 819km. I was heard by OE5OLL (JN68), OK1TEH (JO70), SO3Z (JO82) and OZ1BEF (JO46). Although all these could copy me, I was unable to resolve their SSB signals in the high noise levels I experience at my QTH".

The 70cm Band

Jef ON8NT took part in the 70cm (432MHz) contest on August 8th, with the best DX being G4CLA (IO92).

Satellites

Jef ON8NT monitored three ARISS contacts from the International Space Station (ISS), on August 1st, August 5th and the YOTA contact on August 8th when the initial contact at 1838UTC failed but the contact on the subsequent pass at 2014 worked really well. Additionally, Jef made some contacts via AO-85 with M0RBD (IO92) and DM2MM (JO52).

It was good to hear, too, from **James Preece M0JFP** of the Chertsey Radio Club. James had enjoyed listening to the tests of the two Tanusha satellites prior to deployment from the ISS on July 5th. The satellites broadcast greetings messages in Russian, English, Spanish and Chinese. James also found the ISS crossband repeater operational on July 8th, with no testing of the Tanusha satellites going on, so he took the opportunity to make a quick contact with **Abdel Mesbah M0NPT** (Nottingham), with the uplink on 437.050MHz and the downlink on 145.800MHz, as well as making a contact with EA4SG.

In addition, James reports that the Chertsey Radio Club celebrated the 33rd anniversary of the maiden voyage of the Space Shuttle *Discovery* between June and the end of August, using the callsign **GB8SSD**, and many contacts were made on HF, VHF, UHF and, of course, through satellites. The club also had two different 'Fitter' messages sent through the FUNcube-1 satellite and also sent packet messages through the APRS digipeater on the ISS.

David M0OSA says that he purchased a copy of SatPC32 from AMSAT-UK and has managed to set up his Elad S2 SDR to automatically track AO-73, EO-88 and UKUbe-1 so is now receiving many more telemetry frames from these satellites than before. David says that he has also been digipeating through the ISS on 2m again and has received signals from as far away as Turkey. David uses his FT-2D and the Elk log periodic for his APRS contacts through the ISS.

Mark CT1FJC has made some nice QSOs via FO-29 although he says it would have been more but for some problems with his elevation rotator. However, he received some good service from Yaesu, which helped him get things back together quickly. Highlights of Mark's log are KO4MA (EL88), WB8RJY (EN72), PT2AP (HI22), K8YSE (EN91), HI8KW (FK58), 2M0SQL (IO87) and LX2LA (JN39).

Not much satellite activity at G4VXE this month but it was fun to hear some QSOs via AO-85 from my mobile, especially on one pass when it was good to hear G0ABI and M1BXF working each other, followed by CU2ZG – all friends from Twitter. I still haven't managed a mobile QSO through AO-85 but will have to try harder because I saw a post on the AMSAT North America Facebook group where **Jerry Buxton N0JY** had done just that, using two separate radios and antennas. Jerry even had motorised mounts on the verticals on his car so that he could adjust the elevation for maximum signal. I hasten to add that all of this was achieved when Jerry was stationary!

That's it for this month! Please keep your news coming – it's very much appreciated.

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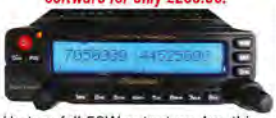

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Steve Telenius-Lowe PJ4DX E-mail: teleniuslowe@gmail.com

The Low Bands at Solar Minimum

Steve Telenius-Lowe PJ4DX takes a look at how best to achieve DX results on the low frequency bands given that the higher bands are likely to be disappointing for much of the next few years.

The next solar minimum isn't expected to occur until 2020. For the next three years conditions on the high bands, particularly 17m to 10m, are likely to decline further. While 20m does not really 'die' like the higher HF bands and remains open to some places throughout the cycle, paths become much less reliable, when they do open they're of shorter duration and signals are weaker than at the peak of the solar cycle. Where, then, do HF operators go to make DX contacts? The answer is the low bands – 160, 80 and 40m – which come into their own at solar minimum as lower levels of solar activity lead to fewer geomagnetic storms that attenuate signals on the low bands.

Into the Dark

Whereas the higher-frequency HF bands are 'daytime' bands and often close soon after sunset (particularly around solar minimum), the opposite is the case on the low bands. Signals propagate towards the dark side of the Earth, so these bands open from just before sunset towards stations to the east that are already in darkness and close soon after sunrise, at which time stations will be worked to the west, where it is still dark. This is due to the fact that the D-layer (the main influence of which on the low bands is to absorb signals) is present during daylight hours when it is being ionised by the sun, **Fig. 1**. However, it quickly disperses at dusk, while the E and F-layers remain ionised and capable of reflecting or refracting signals over long distances. The opposite is the case at sunrise: the F-layer, being at a higher altitude, has already become ionised but the D-layer is not yet sufficiently ionised to absorb signals on the low bands.

The imaginary line separating the dark side of the earth from the sunlit side is known as the 'terminator'. On a globe, it appears as a straight line, as shown in **Fig. 2**, while on a Mercator projection map the terminator describes a curve, the shape of which changes with the seasons. Fig. 2 shows night about to fall across the UK at 1530UTC at the end of December. It is already dark in north-east Scotland but the rest of the UK is still in daylight (or, more likely, twilight). You could expect to make contacts on the low bands with places on the dark side of the Earth such as the Middle East and Indian Ocean area but not with southern Africa or West Africa because they are still in broad daylight.

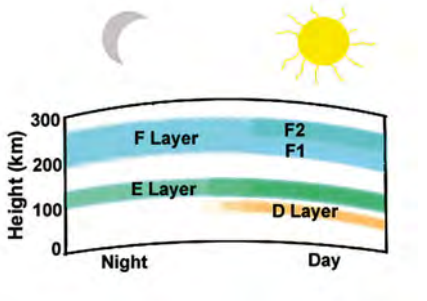

Fig. 1: Ionospheric layers. During the day, the D-layer forms and absorbs signals on the low bands (Graphic: Ionosphere, Wikipedia).

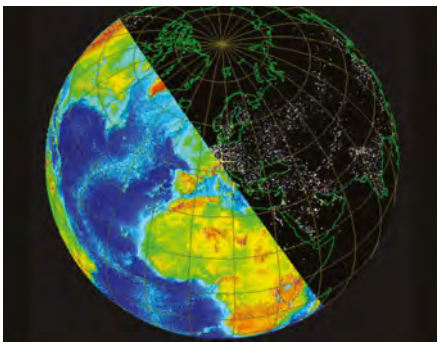

Fig. 2: The terminator is the imaginary line that divides the earth into daylight and darkness hemispheres. This is the situation at 1530UTC just after the winter solstice.

D-layer absorption is greater at lower frequencies, which means that at dusk 40m will open for long-distance contacts before 80m, which in turn opens before 160m. Similarly at sunrise, 160m closes very quickly after dawn, 80m stays open somewhat longer, while it's not unusual to work DX on 40m even a couple of hours after sunrise, particularly in winter. Therefore in the example shown in Fig. 2 only stations in the north-east of Scotland could be expected to make long-distance contacts on 160m, whereas stations anywhere in the UK might be expected to make such contacts on 40m.

Around dawn and dusk a special case exists: the 'greyline', as described by **Steve White G3ZVW** in his March 2017 *Making Waves* column. True greyline propagation only occurs when it is close to dawn at one station and simultaneously close to dusk at the other. However, signal enhancement at dawn and dusk can also occur when there is no greyline path.

Dawn and Dusk Enhancement

I experienced an excellent example of dawn enhancement here in Bonaire in February when I participated in the *CQ* 160m SSB contest. Most stations I worked were in North America but I also contacted 15 in Europe. Of those, 13 (87%) were worked at, or close to, sunrise at the European station's location. While some of the Europeans were audible for quite long periods of time, in most cases signals were only good enough to make a two-way contact within a few minutes of their local sunrise. In several cases, the signal

came out of the noise, peaked for under 10 minutes and then disappeared as the sun rose at their location.

These are good examples of dawn enhancement – but none were greyline contacts because, although it was around sunrise at the eastern end of the path, it was not sunset at the western end. The contacts were made between 11.30pm and 1.45am local time, between 5 and 7.75 hours after sunset.

I experienced the same effect, but with signals coming from the opposite direction, back in 1993 when operating on the VK9MM DXpedition from Mellish Reef, east of Australia. I was on 80m overnight and worked stations across Europe, first from Russia, then eastern Europe, central Europe, western Europe and finally the UK as the sun was setting at those locations. What was interesting was that, with just a few exceptions, stations were worked only at a time close to their sunset. Although there was a full darkness path between stations to the east of the terminator and Mellish Reef, contacts were only made with stations close to the terminator and not those to the east of it.

Once again, these were not greyline contacts because it was not sunrise at my location, but examples of dusk enhancement.

Some Interesting Possibilities

To make long-distance contacts on the low bands a darkness (or nearly darkness) path is required but to work very long distances, especially those close to one's antipodes 20,000km away, requires greyline propagation. Steve White's article, mentioned earlier, explains the mechanics of the greyline well but let's take a look at some examples at different times of year.

At dusk close to the summer solstice – around 2045UTC in the UK – there is a perfect greyline path to the east coast of Australia from the tip of Cape York down to Brisbane, **Fig. 3**, making this a good time to attempt low-band contacts with VK4 stations. There is an issue, though: the limiting factor on the low bands in summer is often a high level of thunderstorm static (QRN). Propagation may be possible but you may be unable to make the contact because of the high level of QRN (*"if you can't hear 'em, you can't work 'em"*, as the old saying goes).

Fig. 4 shows the sunrise greyline at the winter solstice, on December 21st or 22nd. Sunrise is not until about 0830UTC and dawn at this time of year provides interesting DX possibilities. UK sunrise coincides with sunset across Japan and the western Pacific including Papua New Guinea, the Solomon Islands and New Zealand. This is an excellent time for working Japan and strong signals can often be heard on 40m from JA towards the end of December and into January. In the 1990s I was working in Papua New Guinea and as P29DX made several contacts with UK stations on 40m around this time using just a Butternut HF6V vertical.

Fig. 3: Map showing the greyline around sunset UK time at the summer solstice (approx 2045UTC on June 20th or 21st).

Fig. 4: Greyline map around sunrise UK time at the winter solstice (approx 0830UTC on December 21st or 22nd).

Fig. 5: Dusk at the winter solstice (approx 1545UTC on December 21st or 22nd) provides some interesting DX possibilities.

This is also a good time for working New Zealand on 40 and 80m. However, what was said earlier about QRN in the northern hemisphere summer applies equally to the southern hemisphere during their summer months. In practice this means that the spring and autumn equinoxes, when neither location is in summer, are often the best times for working stations in the southern hemisphere.

Fig. 5 shows the greyline around UK sunset at the winter solstice, an excellent time for working the west coast of North America on the low bands. There are many well-equipped stations there with 40m beams (and some even with 80m beams) making contacts possible even for those with modest antennas if you get the timing right.

Low-band contacts with the west coast of North America at sunset are often considered to be via long path because it is daytime immediately west of the UK and dark to the east. Furthermore, almost all the USA and most-populated parts of Canada are in broad daylight, so it is impossible to make low-band contacts with those parts of either country. So it 'feels' like a long-path opening but there is in fact a darkness path to the north-west, across Iceland, Greenland and northern Canada, as can be seen in Fig. 2. Those with directional antennas would be able to tell whether signals come from the direct path to the north-west, the long path to the south-east or perhaps via some skewed path.

We have only looked at the two solstices but there are also interesting possibilities at other times of the year. A real-time greyline map allowing you to check the greyline paths at any time of year can be found at: **www.timeanddate.com/worldclock/sunearth.html**

Power and Antennas

As G3ZVW pointed out, use of *WSPR* can allow low-power signals to be heard at vast distances on the low bands, even if using simple antennas. But for conventional two-way CW or SSB contacts higher power or efficient antennas are more likely to bring success. That's not to say you cannot make DX contacts on the low bands using modest power and antennas. On 40m in particular signals are often strong and from here in Bonaire I have worked many Foundation and Intermediate licensees, European mobile stations and many running 'barefoot' at 100W. Regular reporters to the *HF Highlights* column, such as **Victor Brand G3JNB**, prove that you don't need high power to make DX contacts on 40m.

It is fair to say that 80m, and especially 160m, DX contacts are more difficult than on 40m. For anyone disappointed in current propagation conditions on the high bands and looking for DX on the low bands, my advice would be to concentrate initially on 40m.

Try to put up an efficient antenna. Random length wires requiring an ATU, any multi-band antenna such as a G5RV, trap vertical or trap dipole or any form of 'shortened' antenna are all best avoided. Instead, if you can, put up a dedicated, resonant 40m antenna. For DX working horizontal antennas such as dipoles should ideally be at least half a wavelength above ground, which means 20m, about 65ft. That's all right if you have a tower but most in the UK don't. Lower antennas will also work but won't provide low angles of radiation that are ideal for long-distance working. A better option is a vertical.

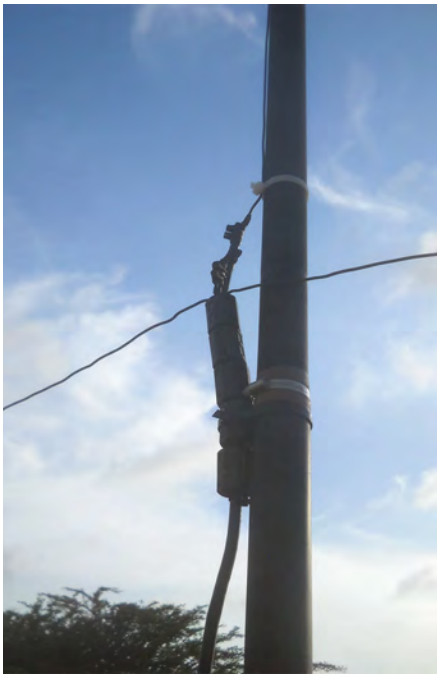

Fig. 6: The feedpoint of the PJ4DX 40m elevated quarter-wave vertical. Based on a 12m Spiderbeam pole, the two elevated radials are 2m above ground. Five large ferrites over the coax form a common mode choke.

One of the best and yet simplest antennas for 40m DX working is the elevated quarter-wave vertical, which can be built easily using a fibreglass pole such as those made by Spiderbeam and sold in the UK by Nevada (see websites below). Using a 12m (39ft) pole means the feedpoint is 2m above ground, the advantage of which is that elevated radials can be used, **Fig. 6**. A pair of elevated quarter-wave radials are sufficient, provided they are in a straight line (at 180° to each other). If a shorter 10m pole were used, the feedpoint would be at ground level, necessitating the use of ground radials and many more would be required for the antenna to work efficiently.

http://spiderbeam.com
www.spiderbeam.us
www.nevadaradio.co.uk

A simple but effective 40m beam can be made by phasing two such verticals as I described in the April 2015 issue of *PW*. I used the 2-element array for two years but found it worked too well: while it provided gain in the direction it was firing, it was at the expense of coverage in other directions. I reverted to a single elevated quarter-wave vertical at the end of last year and was rewarded with DX contacts with the Far East, Oceania, Central Asia and Africa over the winter.

On 80m a full-size quarter-wave vertical is an excellent performer but, at 20m (65ft) high, not everyone will be able to put up such a tall structure. A good second best is the quarter-wave inverted-L, with as much vertical as possible and the remaining wire brought out horizontally (if possible) or else sloping as gradually as possible towards the ground. By the time we get to 160m, a full-size quarter-wave vertical is beyond the scope of all but a few, so the inverted-L is often the antenna of choice for 160m DXers. Whether full size or inverted-L, the ground system is important with all verticals so, unless you use elevated radials, lay out as many radial wires as possible on the ground.

Conclusion

If you enjoy working DX when propagation is good, don't give up when the high bands are apparently 'dead' during the solar minimum. Instead give the low bands a try: there's more DX there than you might imagine. This is particularly so during solar minimum: (a) because DX stations also find conditions poor on the higher bands so they naturally migrate down to 40, 80 and 160m and (b) because conditions tend to be better on the low bands during solar minima anyway.

Use the phenomena of dawn and dusk enhancements and the greyline to help your DXing: use sunrise and sunset tables or a real-time greyline map to know where and when to expect openings to occur. The QRZ.COM website shows accurate sunrise and sunset times, updated daily, for individual stations if the callsign holder has provided their latitude and longitude or Grid locator (go to **www.qrz.com/db/** followed by the callsign of the station concerned, then click on 'Detail'. You'll need to register but it's free of charge.)

Use the best possible antenna you can. All antennas work but compromise antennas are unlikely to produce the best results. Fortunately a simple quarter-wave vertical can be an excellent performer, particularly if it is elevated a couple of metres above ground and, on 40m at least, it is not a difficult antenna to put up.

• E-Mail: practicalwireless@warnersgroup.co.uk

FT8 Update

Mike Richards G4WNC has the latest FT8 news, thoughts on keeping accurate time on a Raspberry Pi and a first look at an interesting SDR module from Analog Devices.

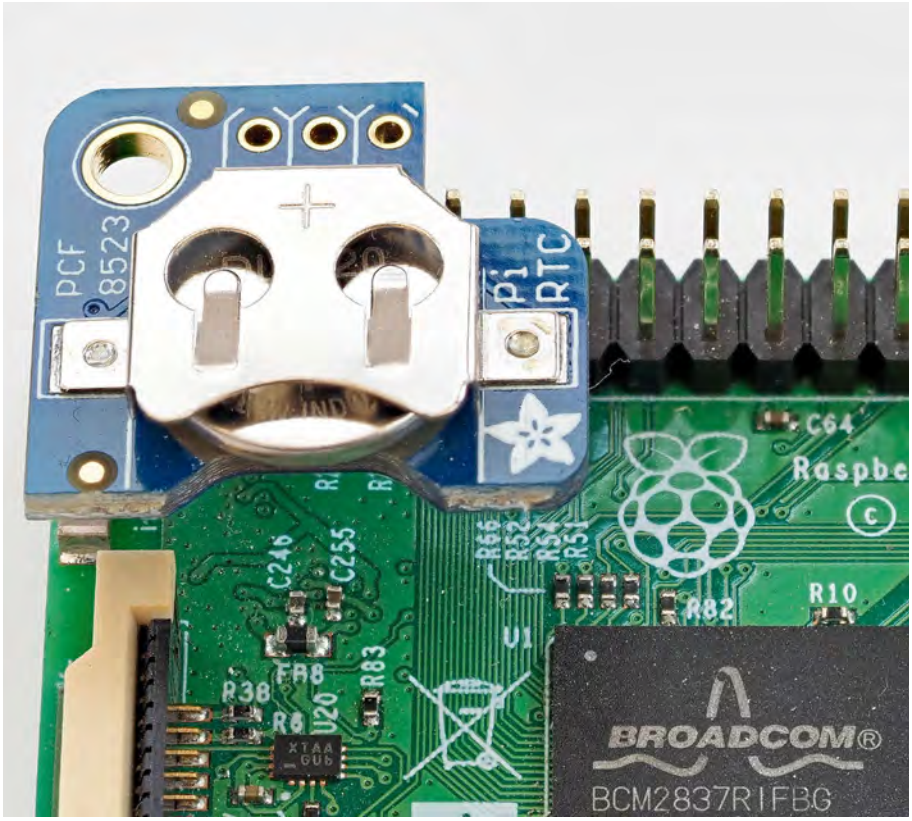

Fig. 1: RTC Clock fitted to a Raspberry Pi 3.

Following my introduction to FT8 last month, the software has been updated and it's essential that you use the latest release. Due to the immense popularity of the mode, the development team are pulling out all the stops to clear any bugs and to make the system as versatile as possible. At the time of writing, the latest software revision is WSJT-X v1.8.0 rc 2 and it's available from:

www.physics.princeton.edu/pulsar/K1JT/wsjtx.html

Much of the current focus of the development team is on making FT8 into a very effective and fast contesting mode to speed up the handling of pile-ups. If you're a contest operator and not using the latest software, you will miss out on valuable contacts.

Raspberry Pi Time

With the range of data modes software that's now available for Raspberry Pi, it has become a very attractive proposition as a cost-effective data modes terminal for portable or holiday use. One potential problem with portable or holiday operating with the Pi is timekeeping. The Raspberry Pi doesn't have a built-in Real Time Clock (RTC) to keep track of the time when the Pi is powered off. As a result, if you start the Pi without an internet connection, the clock will be wrong. That can be a problem because many of the new data modes, particularly weak signal modes such as WSPR, JT65 and FT8 demand an accurate clock. Fortunately, the problem is easily solved thanks to the availability of some very cheap, plug-in, real-time clock modules. These modules comprise a reference crystal oscillator and a control IC, rather like the electronics in a modern watch. These tiny units normally connect directly to the GPIO pins on the Pi as shown in **Fig. 1**.

The two most commonly used RTC chipsets are the CF8523 and the DS3231. Of these, the DS3231 appears to be the most accurate so is probably the one to go for. Prices for these plug-in boards are very low and well-known suppliers have them available for around the £5-£7 mark. You can find even lower prices on eBay but because we're looking for accuracy here I'm not sure that that's the best way to go! To maintain the time when the Pi is turned off, the RTC modules use either a small button cell or a supercap. For most, the supercap is probably the best option because it offers a maintenance-free solution. All the RTC modules I've seen for the Pi use the I2C serial interface to communicate with the Pi and that requires access to the I2C pins plus a power supply. On the Pi these pins are very conveniently grouped together at the top of the GPIO port. **Fig. 2** shows a popular CF8523 module while **Fig. 3** shows the more accurate DS3231 module that uses a single line connector.

In addition to fitting the RTC module we need to make some changes to the Pi configuration so it will use the new board as its time source.

The first task is to enable the I2C communication port. Here's how to do that:

- Go to the Pi menu button – Preferences – Raspberry Pi Configuration.
- Click the Interfaces tab and enable I2C.
- Now let's install some software to check the I2C and make sure our RTC is visible:
- Open a terminal window and type: **sudo apt-get install python-smbus i2c-tools**
- **NB:** If you're using the latest Stretch release, you will find that these are already installed.
- Now run the i2c test by typing: **sudo i2cdetect -y 1**
- If all is correct, you should see a matrix printed on the screen with the number 68 displayed on the intersection of lines 6 and 60, **Fig. 4.**

Now we need to install the kernel driver

for the RTC chip as follows:

- Open a terminal window and type: **sudo nano /boot/config.txt** This will open the boot config file. **NB:** If you get an empty file, you've mistyped the name!
- Scroll to the bottom of that file and add the following line according to the chipset of your RTC:
- dtoverlay=i2c-rtc,pcf8523
- **dtoverlay=i2c-rtc,ds3231**
- Type **ctl-x followed by return** to close and save the file.
- Now reboot the Pi with: **sudo reboot**
- When the Pi restarts, use the i2c tool to make sure the kernel driver has loaded. Here's the command: **sudo i2cdetect -y 1** and this time you should see **UU** displayed at the intersection of 60 and 8.

That completes the first stage and your new RTC is ready for use by the Pi but we have a couple more things to do to complete the process. When the Pi is running without a RTC, it uses a small app to create a fake hardware clock so we need to remove this or it will interfere with our RTC. Here's the removal process:

- Open a terminal and type: **sudo apt-get -y remove fake-hwclock**
- We also need to stop the system from trying to auto-run the fake clock at start-up by typing: **sudo update-rc.d -f fake-hwclock remove**
- Now we can let the built-in RTC code run as follows: **sudo nano /lib/udev/hwclock-set**
- Add a # symbol to comment-out the following lines (they are near the top of the file)
- #if [-e /run/system/system] ; then
- #exit 0
- #fi
- Type **ctl-x followed by Return** to close and save the file.

At this point, the time will be wrong, so connect the Pi to the internet and wait a few minutes for it to synchronise.

Now write the time to the RTC with**: sudo hwclock -w**

Check the time with: **sudo hwclock -r**

That's it, the Pi will now keep time even if it's away from the internet. Accuracy for the low cost PCF8523 modules is around two seconds per day and the battery life should be about five years. If you want greater accuracy, I suggest you go for the DS3231 module because it adds temperature compensation to the oscillator and can maintain the time within one second per week over the temperature range 0-40°C.

Fig. 2: CF8523-based RTC module.

Fig. 3: DS3231-based RTC module.

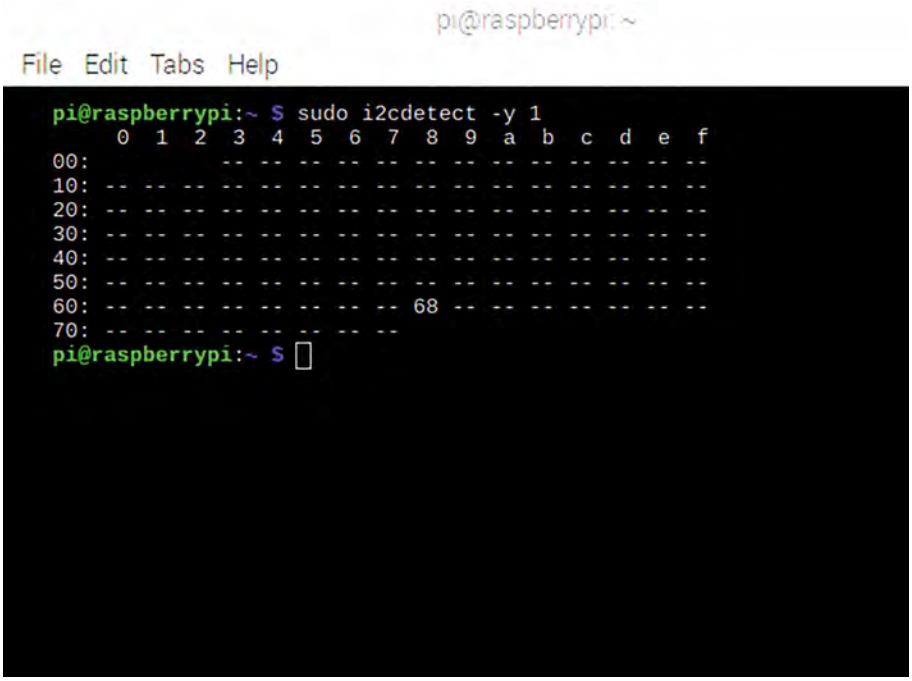

Fig. 4: I2C detect software showing that the I2C device is connected and powered.

New SDR from AD

The Pluto SDR from Analog Devices has been promised for months but has only just made it into the supply chain, **Fig. 5**. I pre-ordered mine back in April and it arrived in the middle of August! The Pluto SDR is a complete SDR transceiver module that is intended for use in colleges and universities to help teach SDR principles. At its heart is the AD 9363 agile transceiver chip with a frequency range of 325MHz to 3.5GHz using 12-bit analogue-to-digital conversion (ADC) in both the receive and transmit chain. The ADC sample rate can be up to 61.44MHz and the default maximum bandwidth is 20MHz. In addition to the transceiver chip, the Pluto SDR features all the supporting hardware, including a Xilinx Zynq (XC7Z010) system-on-a-chip device that provides FPGA facilities for decimation along with a processor (ARM® Cortex™ A9 Core) that can run Linux, **Fig. 6**. In essence, it has all the basics of a decent 12-bit SDR transceiver. What makes it particularly attractive is the introductory price of just $99. This works out at just over £90 once you've added VAT and carriage. The best source is currently DigiKey but Farnell have it listed so they should have stocks at some point. However, the module is selling very quickly with the first 1,000 selling out in days.

While the basic unit is quite attractive, there are a couple of simple firmware mods that can be applied to give the unit a much wider range. This is possible because the AD9393 is one of a series of agile transceiver devices. These are effectively the same chip design but produced to different tolerances. The default 325MHz to 3.5GHz limit represents the range over which the AD9363's performance is guaranteed to be within specification. However, it seems that this

can be expanded by setting the firmware for the higher spec AD9364 that has a range of 70MHz to 6GHz and a bandwidth of up to 56MHz. Details of how to apply the update can be found on the Analog Devices website here:
https://wiki.analog.com/university/tools/pluto/users/customizing

When you get to that site, scroll down to the section titled Updating to the AD9364.The update is very simple to apply because you just have to connect Pluto SDR to your USB port (after installing the Pluto SDR drivers) and use a free terminal program such as PuTTY to log into the Pluto and send the commands. This mod was included in the AD official documentation because some of the earliest Pluto releases did use the AD9364 chip. However, other users that have AD9363 branded chips in their Pluto have reported success with the update. I tried it on my AD9363-marked device and the range was successfully extended. Just a word of warning; the range extension you get will be at a performance cost with respect to the published specification.

As you might expect, there is lots of interest in the Pluto SDR but it's still very early days in terms of ready-made software being available. At the time of writing, the easiest way to use the Pluto as an SDR was to use SDR Sharp along with a plug-in by **Tobias Madel**. You can get the plug-in from here:
https://github.com/Manawyrm/sdrsharp-plutosdr

Once you have unzipped the download, just copy the files to your SDR Sharp installation directory. **NB:** This plug-in only works with the 32-bit version of SDR Sharp. When you next open SDR Sharp, you will see the Pluto SDR displayed in the list of sources. While internally the Pluto SDR can deliver a bandwidth of up to 56MHz, the data throughput of the USB port is limited to about 4MHz. In practice, I found I was still seeing dropouts at 4MHz so 3MHz was the maximum practical bandwidth for my setup. If you want to start playing on a more basic level, Analog Devices have a simple scope/spectrum analyser package available for Windows and you can get it here:
https://github.com/analogdevicesinc/iio-oscilloscope/releases

The Pluto is also supported in GNU Radio and Linux users can run the latest GQRX SDR with support for the Pluto. Watch this space for more information!

Fig. 5: Analog Devices Pluto SDR.

Fig. 6: A peek inside the Pluto showing the AD9363 and the ZYNQ FPGA/Processor.

Tony Jones G7ETW E-mail: charles.jones125@yahoo.co.uk

An Arduino Morse Tutor

Inspired by the Datong D70 of years gone by, Tony Jones G7ETW has reproduced its functionality using an Arduino.

Fig. 1: The original Datong Morse tutor.

This is the first part of a two-part article about a home-brew Morse tutor I built using an Arduino. I have wanted to do some Arduino development for some time so I bought one and gave myself the task of replicating a Datong D70, **Fig. 1**. Aside from accepting a key input, my ARD70, **Fig. 2**, does everything the original did, with some new features added.

See **Fig. 3** for a schematic of the ARD70. If you've never even touched an Arduino, don't worry. This is an easy project to get you started, with a very useful end product.

Project Requirements

I used a 'genuine' Arduino Uno R3, as indicated by the gold component, **Fig. 4**, and mine cost £18 from Amazon. Arduino authenticity is an odd concept because Arduino technology is open source but

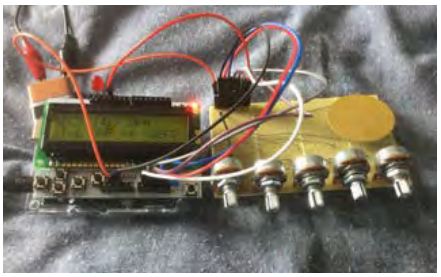

Fig. 2: Tony's ARD70 – not as pretty but it does the same job!

by buying 'genuine' I was supporting the Arduino developers, which can be no bad thing.

Many people buy Chinese 'copies' – some call them fakes – and in theory that is perfectly fine. They are compatible and look identical except for the logo. There are a couple of things to be careful of, though. Firstly, some copy boards have a different serial-to-USB chip, called a CH340, and the standard Interactive Development Environment (IDE) install does not have drivers for that. This results in the board not being recognised by the IDE software. Secondly, some Arduino clones – is that a kinder description? – do not have the 'bootloader' installed. This is the on-board software that makes it possible to download an executable program to an Arduino and run it.

These problems are fixable – see Useful Information – but they might put a beginner off. I'd advise using a genuine board, at least initially.

There are many bigger and more powerful models of Arduino such as the Mega2560 and they would also work for this project. I chose a Uno R3 because it's the hardware that the common books and Arduino online help feature.

Breadboard

I used a small breadboard with 64 rows of five connections each side, perfect for most of my projects. You'll also need some pin-to-pin, socket-to-socket and pin-to-socket multi-coloured breadboard connecting leads.

Components

In addition to the Arduino, you'll need five 10kΩ linear potentiometers, one 5V LED (with a built-in resistor or a 2V LED and a suitable (say, 680Ω) resistor), and one audio sounder, preferably an Arduino Piezo Speaker board.

LCD Shield, 16 Columns by 2 Rows

A shield is a board that plugs into an Arduino's vertical edge 'header' connections to link with the Arduino. An LCD shield provides a simple character display but there are shields for anything imaginable and anyone can design and build their own.

The LCD shield I used has buttons for left, right, up, down and select but these don't do anything unless there is code in the program, called a sketch, for them to be active. I wanted the ARD70 to have potentiometer controls so I didn't use the buttons.

There are two main types of LCD shields, those using the 4480 display driver and those using a 1602 chip. The 4480 type is the most common, but I used a 1602 type (by mistake).

There are also two ways LCD shields connect and communicate with the Arduino. Simple ones use six digital pins but there is a type that uses IIC ('I-squared C'), which communicates via a bus. I will

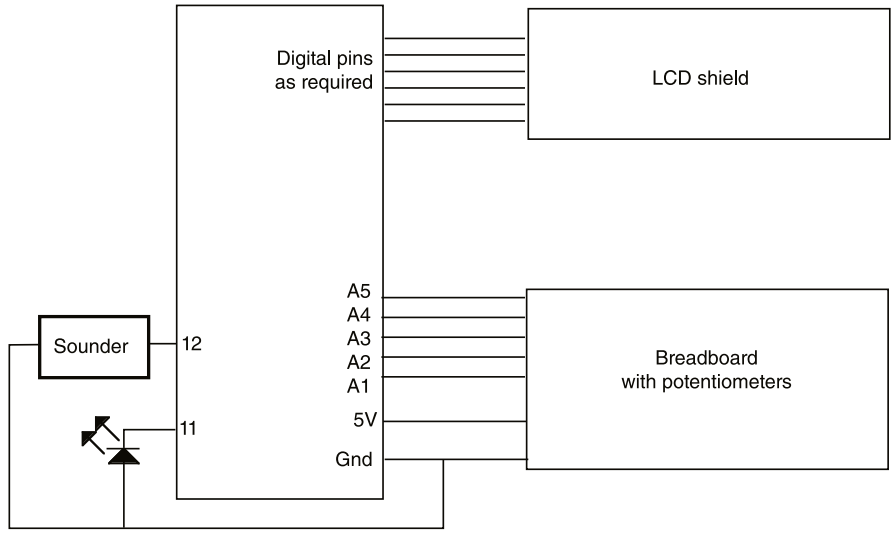

Fig. 3: Schematic of the ARD70.

Fig. 4: The 'genuine' Arduino Uno R3.

use one of these for Part 2 to show the difference but for this stage of the project a 6-pin one is required. See Useful Information for 4480- and 1602-type interface pin numbers (but please check when you buy!).

The photo, **Fig. 5**, shows the display working on the Arduino. Two rows of 16 characters is not much – brevity is a useful Arduino skill!

Arduino Sketch Code

My program source is not strictly a requirement, since anyone can write their own code for this application. But my code is all here and it is tested so it will work without tinkering. I've put it on my website (again, see Useful Information) for downloading. Use it with my pleasure but in the spirit of Arduino, if you modify it and it stops working, you're on your own!

Making up the Breadboard

Fit VR5 to VR1 potentiometers to the breadboard. They will fit nicely on one side (see Fig. 5). **Fig. 6** shows the circuit diagram. An earlier version used trimmer-type variable resistors that had to be turned with a screwdriver but this was not very convenient.

A note of caution here: an Arduino cannot sink or source more than 40mA on any pin. I used 10kΩ potentiometers but any resistance value over 1kΩ would be safe.

VR5 to VR1 all work the same way. A permanent 5V line goes to one side of the potentiometer and the other side goes to ground. The wipers go to analogue pins A5 to A1 respectively and the Arduino sees a voltage that changes when the potentiometer is turned but otherwise stays constant. The Arduino does an analogue-to-digital mapping and makes an integer from 0 to 1023 available to the programmer.

VR5, the speed control, uses analogue Pin A5. As standard, sending speed (variable name spd) can be varied from 5 to 45 words per minute.

To code for easily alterable upper and lower limits, I used a constrain command but this could have been done with a couple of 'if' statements.

```
if (spd > MAXSPD) { spd = MAXSPD; }
if (spd < MINSPD) { spd = MINSPD; }
```

The gap control, VR4, uses analogue Pin A4. This sets the length of the gap between characters and is processed in tenths of a dot. The gap between dots and dashes within a character is the standard one dot.

As standard, the character-to-character gap (variable name gap) can be varied from 5 to 45 tenths of a dot at the character speed selected. This is converted to 0.5 to 4.5 dots in blink_morse_led.

VR3, the type of character sent control, uses analogue Pin A3. The original D70 had three character modes selected by a centre-locking two-way switch. Up was for numbers, down was for letters and the middle position was for mixed characters. The ARD070 has an additional Pseudo Callsign mode and the breadboard would have required four switch positions. A potentiometer with its track divided into four ranges of 255 was easier.

As standard, character group type (variable name typ) can be varied from 10 to 40, corresponding to letters, numbers, mixed characters and pseudo callsigns (PCS on the display).

VR2, the tone frequency control, uses analogue Pin A2. The original D70 had an internal potentiometer to vary the beep's audio frequency. The ARD70 brings this out for easier user control. As standard, tone frequency (variable name frq) can be varied from 250 Hz to 2500 Hz.

VR1, the Seed control, uses analogue

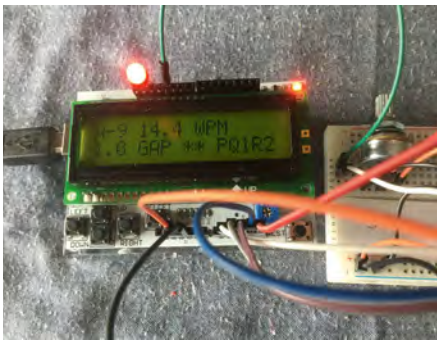

Fig. 5: A close-up of the display.

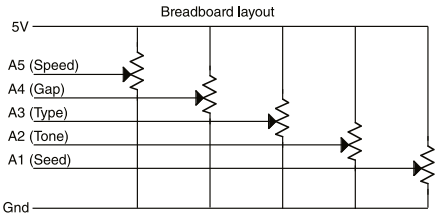

Fig. 6: The breadboard layout.

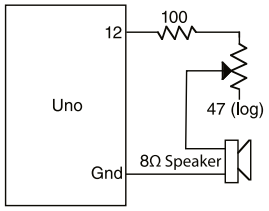

Fig. 7: Using a loudspeaker with current-limiting potentiometer.

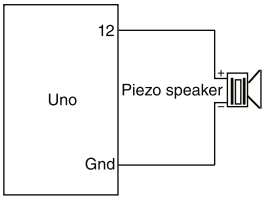

Fig. 8: Using a piezo loudspeaker.

pin A1. This controls an internal Arduino variable that is instrumental in Arduino randomness. See Random Numbers sidebar.

Getting Sound out an Arduino

This is a Morse tutor so it needs to sound out the characters. The output is created by use of the tone command, which puts out a variable frequency 5V square wave. This appears at the digital output pin specified (pin 12 in this case).

A small loudspeaker can be used, although the low impedance is a problem. The signal is a square wave so an 8Ω speaker would draw 625mA peak current. This is too much for an Arduino's long-term survival.

To protect the microprocessor, a resistor – usually 100Ω, although that isn't really enough – is required in series with a loudspeaker. This limits the current to about 23mA on average, although the peak current still exceeds 40mA. If a volume control is wanted, a small value potentiometer of, say, 47Ω could be used in addition, **Fig. 7**. Because of the 100Ω, very little of the 5V appears across the loudspeaker so the volume is low.

A better option is to use a piezo speaker such as musical greetings cards have. A piezo speaker is a high-impedance device so a current-limiting resistor is unnecessary. These devices can stand much higher voltages than the 5V available so again the volume is low, **Fig. 8**.

The best option is to use an Arduino Piezo Speaker board. These are designed for Arduino and Raspberry Pi use and have tiny piezo speakers in a silo-like housing. The board has a third connection for a permanent 5V supply and what looks like a one-transistor amplifier. Consequently, the volume is much louder, especially if the frequency is varied to find the device's 'sweet spot'. In the photo, **Fig. 9**, the size of the board can be seen, also the confusing legend 'Piezo Buzzer'. To my mind, a piezo buzzer is a bulkier device with a built in oscillator – this is not the same thing.

I did try a piezo buzzer as I understand it. These just need DC and make a lot of sound, but offer no variability, **Fig. 10**. The 12V buzzer I used takes about 15 mA on 5V so I was confident that the Arduino's digital output pin was in no danger.

The Code

The code is reproduced in full. It is very much beginners' code – no ternaries, for example – although there are some statements within statements and multi-statement lines. I won't explain everything, because many *PW* readers have done programming, I'm sure. The sketch is well commented and there is a wealth of online material for Arduino programmers (see Useful Information). The code is changing constantly as I tinker with it so go to my website for the latest version. There are some aspects of the code that I would like to cover, though.

Sending speed, type of characters sent, the character-to-character gap and the sounder frequency are checked for every pass-through loop but this happens before the looping of blink-morse-led starts. This means that changes to any of these settings do not take effect until loop next starts.

Speed is based on the 'PARIS' test, in which 50 dot-length segments, including gaps, make up one PARIS group. If PARIS is sent at 12WPM, one dot takes 100ms. If the gap is set to 2.5 dots, this lengthens to 250ms at that speed.

In setup, there is a Serial.begin(9600) statement. The ARD070 does not need this to run but some debug displays (done using the Serial.println instruction) are bound to be useful at some point so I'd advise leaving it in.

Random Numbers

When random is used, Arduino uses a long series of numbers controlled by a 'seed' and for any one seed, there is one series of numbers. Think of several decks of playing cards, each shuffled correctly and randomly but in its own fixed way. Within this series, the Arduino does generate random numbers but from power-up or reset, they will always be the same ones and in the same sequence.

The usual way of getting random numbers from loop to loop is to set the seed by reading the voltage from a floating (unterminated) analogue input pin. The theory is that such a read will return a number from 0 to 1023. I tested this with a simple sketch and nothing connected to the board except the USB lead. As Fig. 10 shows, an unterminated pin's state isn't very random. This is not a hardware error in my Uno; it's a common problem well known to Arduino developers.

There are sophisticated random number generator shields available, using noise generated by zener diodes or binary junction transistors. These are used where guaranteed randomness is required, for example in cryptography applications, but I thought having an extra board just to get a random number was overkill for this project.

I consequently added another control called Seed, which is user-controlled in the same way as the other run-time parameters. This happens in setup, so to set the ARD070 onto a new series of randomness, the user must turn the Seed control then press the Arduino's reset button.

Sketch code: Here is the code. It is also available to download from my website:

```
//------------------- start sketch ARD70k
// ARD70 sketch written by Tony Jones May 2017
// Sketch is a software implementation of a D70 morse tutor with added
features
// Developed on Arduino Uno R3, should run on any Arduino

#include <LiquidCrystal.h>
LiquidCrystal lcd(8, 9, 4, 5, 6, 7);
// compiler substitutions
#define MAXSPD 45 // Words per minute
#define MINSPD 5
#define MAXGAP 45 // tenths of a dot
#define MINGAP 5
#define MAXTON 2500 // Hz
#define MINTON 250
#define ASCAVAL 65 // decimal value of character 'A' in ASCII
#define ASCZVAL 90 // char Z
#define ASC0VAL 48 // char 0
#define ASC2VAL 50 // char 2
#define ASC8VAL 56 // char 8
#define ASC9VAL 57 // char 9
#define DOTSTD 1200 // one dot at 1 wpm takes 1200 ms based on PARIS
standard
#define DSHDOT 3 // standard dash is 3 dots long
#define HLFSEC 500
#define TWOSEC 2000

// constants
const int cwledop = 12;
const int cwspkop = 11;

// no changing global variables

//------------------- start setup
void setup()  // runs once
{
  float potval;
  int sed;
  Serial.begin(9600);  // necessary for using debug prints to serial
monitor in ide
  pinMode (cwledop, OUTPUT);
  lcd.begin(16, 2); lcd.clear(); lcd.setCursor(0, 0); lcd.print(F("D70
V3.5 ")); delay(TWOSEC);

// get new seed for random number generation by pressing reset
  potval = abs(analogRead(A1));
  sed = (int) potval;
  randomSeed (sed);
}

//------------------- enddd setup

//------------------- start loop
void loop()
{
  int frq, i, j, typ;
  float gap, spd;
  long x;
  char cwmsg[6], dsptyp[5];
  float potval;

  // get wpm
  potval = abs(analogRead(A5));
  spd = potval * MAXSPD / 1023.0;
  spd = constrain(spd, MINSPD, MAXSPD);



// get gap
  potval = abs(analogRead(A4));
  gap = potval * MAXGAP / 1023.0;
  gap = constrain(gap, MINGAP, MAXGAP);

// get typ
  potval = abs(analogRead(A3));
  typ = ( (int)(potval / 255) + 1) * 10; // will give  10 lets, 20 nums,
30 mixed, 40 pseudo callsigns
  typ = constrain(typ, 10, 40);

// get tone freq
  potval = abs(analogRead(A2));
  frq = (int) potval;
  frq = potval * MAXTON / 1023.0;
  frq = constrain(frq, MINTON, MAXTON);
  switch (typ) {
    case 10: for (i = 0; i < 5; i++) {
        x = random(ASCAVAL, ASCZVAL + 1);
        cwmsg [i] = (int) x;
      }
      strcpy(dsptyp, "A-Z ");
      break;
    case 20: for (i = 0; i < 5; i++) {
        x = random(ASC0VAL, ASC9VAL + 1);
        cwmsg [i] = (int) x;
      }
      strcpy(dsptyp, "0-9 ");
      break;
    case 30: for (i = 0; i < 5; i++) {
        x = 60; // get random chars until in 0-9 or A-Z
        do {
          x = random(ASC0VAL, ASCZVAL + 1);
        } while ((x > ASC9VAL) && (x < ASCAVAL));
        cwmsg [i] = (int) x;
      }
      strcpy(dsptyp, "Mxd ");
      break;
    case 40: x = random(ASCAVAL, ASCZVAL + 1); cwmsg [0] = (int) x;
      switch (cwmsg [0]) {
        case 'G' :  {
            x = random(ASC0VAL, ASC8VAL + 1);  // we don't want G9
            cwmsg [1] = (int) x;
            break;
          }
        case 'M' :  {
            x = random(ASC0VAL, ASC2VAL + 1); x = 3 * (x - ASC0VAL); //
gives us ch 0, 1 or 2
            cwmsg [1] = (int) (x + ASC0VAL); break;
          } // we only want M0, M3 and M6
        default :  x = random(ASC0VAL, ASC9VAL + 1); cwmsg [1] = (int) x;
// other countries to be added later
      }
      x = random(ASCAVAL, ASCZVAL + 1); cwmsg [2] = (int) x;
      x = random(ASCAVAL, ASCZVAL + 1); cwmsg [3] = (int) x;
      x = random(ASCAVAL, ASCZVAL + 1); cwmsg [4] = (int) x;
      strcpy(dsptyp, "PCS ");
      break;
  }
  cwmsg [5] = '\0';
  lcd.clear(); lcd.setCursor(0, 0); lcd.print(dsptyp);
  lcd.print(spd, 1); lcd.print(F(" WPM "));
  lcd.setCursor(0, 1); lcd.print(gap / 10.0, 1); lcd.print(F(" GAP **
"));
  lcd.print(cwmsg); delay (HLFSEC);
  for (i = 0; i < 5 ; i++) {
    blink_morse_char (spd, gap, cwmsg [i], frq);
  }
}

//------------------- enddd loop

// ------------------begin called functions

//------------------- start blink_morse_char
void blink_morse_char( float fspd, float fgap, char cwchar, int ftone)
{
  int i;
  char segs [5];
  switch (cwchar) {
    case '0' : strcpy(segs, "-----"); break ;
    case '1' : strcpy(segs, ".----"); break ;
    case '2' : strcpy(segs, "..---"); break ;
    case '3' : strcpy(segs, "...--"); break ;
    case '4' : strcpy(segs, "....-"); break ;
    case '5' : strcpy(segs, "....."); break ;
    case '6' : strcpy(segs, "-...."); break ;
    case '7' : strcpy(segs, "--..."); break ;
    case '8' : strcpy(segs, "---.."); break ;
    case '9' : strcpy(segs, "----."); break ;
    case 'A' : strcpy(segs, ".-"); break ;
    case 'B' : strcpy(segs, "-..."); break ;
    case 'C' : strcpy(segs, "-.-."); break ;
    case 'D' : strcpy(segs, "-.."); break ;
    case 'E' : strcpy(segs, "."); break ;
    case 'F' : strcpy(segs, "..-."); break ;
    case 'G' : strcpy(segs, "--."); break ;
    case 'H' : strcpy(segs, "...."); break ;
    case 'I' : strcpy(segs, ".."); break ;
    case 'J' : strcpy(segs, ".---"); break ;
    case 'K' : strcpy(segs, "-.-"); break ;
    case 'L' : strcpy(segs, ".-.."); break ;
    case 'M' : strcpy(segs, "-"); break ;
    case 'N' : strcpy(segs, "-."); break ;
    case 'O' : strcpy(segs, "---"); break ;
    case 'P' : strcpy(segs, ".--."); break ;
    case 'Q' : strcpy(segs, "--.-"); break ;
    case 'R' : strcpy(segs, ".-."); break ;
    case 'S' : strcpy(segs, "..."); break ;
    case 'T' : strcpy(segs, "-"); break ;
    case 'U' : strcpy(segs, "..-"); break ;
    case 'V' : strcpy(segs, "...-"); break ;
    case 'W' : strcpy(segs, ".--"); break ;
    case 'X' : strcpy(segs, "-..-"); break ;
    case 'Y' : strcpy(segs, "-.--"); break ;
    case 'Z' : strcpy(segs, "--.."); break ;
  }
  int cwdott = DOTSTD / fspd;
  int cwdash = cwdott * DSHDOT;
  int cwcgap = (cwdott * fgap) / 10;
  for (i = 0; i < strlen(segs); i++) {
    digitalWrite(cwledop, HIGH); tone(cwspkop, ftone);
    switch (segs[i]) {
      case '.' : {
          delay(cwdott);
          break;
        }
      case '-' : {
          delay(cwdash);
          break;
        }
    }
    digitalWrite( cwledop, LOW); noTone(cwspkop); delay(cwdott);
  }
  digitalWrite(cwledop, LOW); noTone(cwspkop); delay(cwcgap);
}

//------------------- enddd blink_morse_char

//-------------------enddd called functions

//------------------- enddd sketch ARD70
```

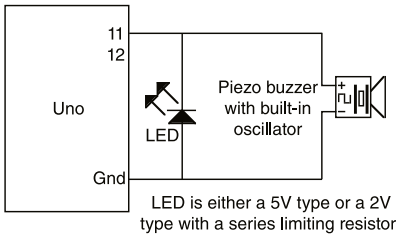

Fig. 9: The piezo speaker with associated circuit board.

The LCD.print statements, where they output fixed string literals, are coded using the F function (see Useful Information). While not absolutely necessary, Arduino's memory management regarding strings makes the routine use of this function very wise. What this non-standard C function does is prevent strings being written to memory twice, thus saving space between the 'stack' and the 'heap'. If that sounds like gobbledegook for now please just take my word for it and always code print using statements for literals using an intervening F macro call such as Serial.println(F("we are here")) rather than Serial.println("we are here").

The case statement in blink-morse-led is hideous but simple and avoids the need for a large string array that could have contributed to heap-stack memory problems. The use of a pictorial dot and dash notation for Morse component segments I also defend. I could have concocted a numeric code, using integers to store the Morse character patterns such as 'B' becoming, say, 3111. That would have saved space, for sure, but unpacking the segments would have been more complicated.

Useful Information

4480-type LCD pins	12, 11, 5, 4, 3, 2
1602-type LCD pins	8, 9, 4, 5, 6, 7
Arduino website	**www.arduino.cc**
Current IDE	V1.8.2, versions for PC, Mac & Linux are available.

Arduino memories and the 'heap-stack' problem:
https://learn.adafruit.com/memories-of-an-arduino/ardiuno-memories
F macro
www.baldengineer.com/arduino-F-macro.html
Fixing problems with copy boards:
www.hackster.io/tomheylen/how-to-fix-bad-chinese-arduino-clones-4ca406
Tony Jones website (to download sketch code):
http://jaredelec.wixsite.com/home
Really good C syntax document:
http://cslibrary.stanford.edu/101/EssentialC.pdf
Datong D70 manuals:
https://sites.google.com/site/datongarchive/d70/d70-manuals

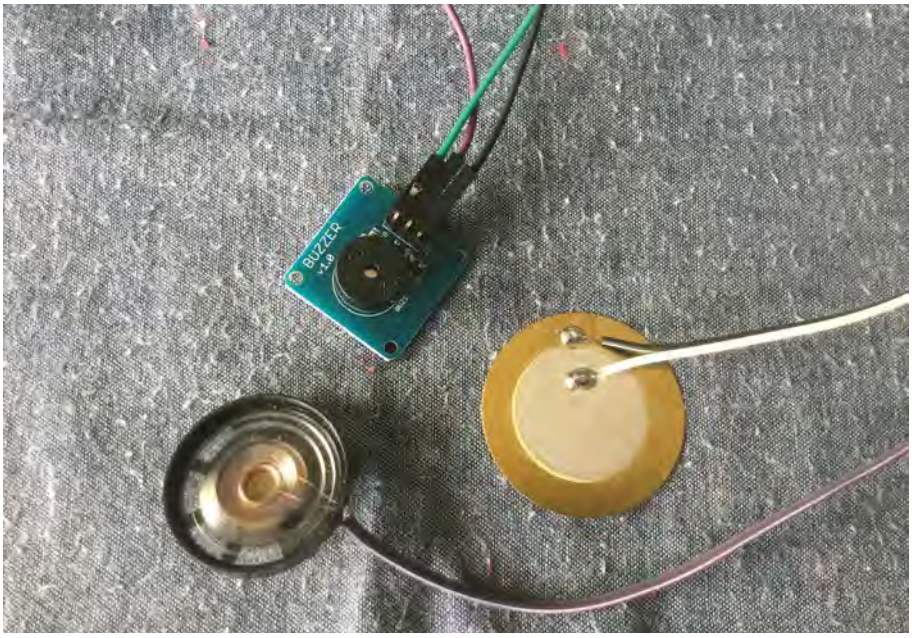

Fig. 10: The piezo buzzer for the Arduino.

Improvements

My ARD70 works but that does not mean it is finished. (Most programmers 'improve' their code to the point that it actually stops working but I resisted that because I want to get on with Part 2.) There are some obvious improvements that could be made.

A stepped sending approach would be nice so someone learning Morse could start with the shorter characters and build up to the full alphabet.

The string processing is ugly. This is because I avoided using string objects to save memory but in hindsight this was unnecessary because the sketch is well within what an Arduino Uno can handle.

The pseudo callsigns are better than nothing and there is a bit of intelligence for basic UK callsigns. For example, the ARD70 will only send G0 to G8 and M0, M3 and M6 calls. But there are no regional locators or suffixes, or maritime indicators, and Intermediate calls are not covered at all. For other countries there is no logic at all to make them realistic. There is much work to be done here.

Special characters such as punctuation could be included. A complete dummy QSO could be generated with 'WX is', 'Rig is' and similar sections.

The ARD070 is not very loud, even with an Arduino piezo speaker board. I could make a case building an audio amplifier in.

A scrolling display would be nice, with a replay button for the last group.

And as the icing on the cake, the perfection of the timing could be altered, with small variations in speed and gap being sent from time to time.

One Last Point

A flashing LED is an unusual feature in a Morse tutor and I intended it to be temporary. This was my first Arduino project and during development a beep would have been annoying so I got a visual display working first. But with my eyes and ears working together, my Morse-reading ability has really come on and I could be on to something here. If manufacturers start building visual CW indicators into their products, you saw it in *PW* first!

Please look out for Part 2 of this article, my Morse reader. It won't be far behind.

• E-Mail: practicalwireless@warnersgroup.co.uk

Callsigns

This month Colin Redwood G6MXL looks at amateur radio callsigns.

Callsign Format	Regional Secondary	Club Regional Secondary
England	E (only for Intermediate)	X
Wales	W	C
Scotland	M	S
Northern Ireland	I	N
Isle of Man	D	T
Guernsey	U	P
Jersey	W	H

Table 1: Regional Secondary Locators that form part of callsign prefixes for callsigns issued by Ofcom.

Callsign Format England	Callsign Format Wales, Scotland, etc.	Type	Notes
M3xxx	M*3xxx	Foundation	
M6xxx	M*6xxx	Foundation	Currently being issued
2E0xxx	2*0xxx	Intermediate	Currently being issued
2E1xxx	2*1xxx	Intermediate	
G2xx	G*2xx	Full	
G3xx	G*3xx	Full	
G4xx	G*4xx	Full	
G5xx	G*5xx	Full	
G6xx	G*6xx	Full	
G8xx	G*8xx	Full	
M0xxx	M*0xxx	Full	Currently being issued
M1xxx	M*1xxx	Full	
M5xxx	M*5xxx	Full	

Table 2: The range of callsigns issued by Ofcom and its predecessors that may be heard on the air.

The recent correspondence in *PW* regarding confusion over certain callsigns caused me to think. It's a long time since I have seen an article covering callsigns in general and UK callsigns in particular.

As I am sure most readers will be aware, to operate an amateur radio station you need to have gained a relevant qualification and then obtained an operating licence and callsign from the licence issuing authority. Amateurs from throughout the United Kingdom (England, Wales, Scotland, Northern Ireland), plus certain Crown Dependencies (Jersey, Guernsey, Sark, Alderney, Isle of Man) all apply to Ofcom for their amateur radio licences.

Anatomy of a Callsign

Callsigns are made up of two parts: the prefix and suffix. It is the combination of prefix and suffix that make the callsign unique. Ofcom issued callsigns usually have prefixes such as M3, MW6, 2M0, 2D1, GI8, MU0, GJ4 and these tell us in which DXCC entity the operator is located and what type of licence they have. For Ofcom issued callsigns, the suffix is generally three letters such as MXL, XTT, IMS. There are, however, exceptions to the above.

Prefixes

The formats of prefixes are subject to international agreement. These prefixes are issued and coordinated by the International Telecommunication Union (ITU) and apply not just to amateur radio callsigns but to all radio callsigns. The registration letters you will see on commercial aircraft, for example, follow a similar pattern and are the radio callsign of the aircraft. The UK has certain initial letters and numbers allocated to it. So only the licensing authority in the UK can issue callsigns starting G, M and 2. Other countries have other prefixes that they can use. Therefore, from the prefix it is possible to tell which country the licence holder is operating from. However, some international prefixes cover a number of territories that we, for our hobby purposes, consider to be separate 'countries' or 'entities' although in UN or ITU terms, they are a single territory. A good example is the VP8 prefix, used from the Falkland Islands, South Georgia, British bases in Antarctica and other sub-Antarctic islands.

For Ofcom issued personal and club callsigns, in most cases it is necessary to insert a 'regional secondary locator' into the callsign issued. If, for example, you are issued a callsign starting M6 and operate from Scotland, then your prefix becomes MM6. The list of these regional secondary locators is shown in **Table 1**. Note that club callsigns are issued to full licence holders and that the club regional secondary locator is only therefore applicable to full licences, for example GX4PRS and GP3ZME. It's worth a mention that commercial callsigns issued in the UK don't follow the regional secondary locator system. It is something that amateurs requested many years ago to distinguish between what, for purposes of our various awards, are separate 'countries'.

It should be noted that over the years callsigns have been issued from different series and allocations to the ones currently being used (as an example, Channel Island callsigns used to start with GC whereas this prefix is now used for club stations operating from Wales).

Suffixes

For Ofcom issued callsigns, the suffix is generally three letters such as MXL, XTT, PRS, although some 2-letter suffices were

GB0xx	GB0xxx
GB1xx	GB1xxx
GB2xx	GB2xxx
GB4xx	GB4xxx
GB5xx	GB5xxx
GB6xx	GB6xxx
GB8xx	GB8xxx

Table 3: Prefixes used for most special event callsigns issued by Ofcom.

issued in the 1920s and 1930s. As I'll explain, there are some exceptions.

Over the Years

Over the years, numerous callsign formats have been issued by Ofcom and its predecessors. The main reasons for the changes have been as a result of all the suffixes in a particular prefix series being used up or licence types and rules changing.

In some cases, old callsigns of deceased amateurs have been reissued to family or friends of the deceased, or to their local amateur radio society. The rules for reissuing callsigns have recently been reviewed by Ofcom and these days tend to follow more strict guidelines than previously. The option to choose your suffix (provided it hadn't already been issued), which was possible for a few years, has been withdrawn by Ofcom. In practice, it really doesn't matter how these various callsigns have come into being because any of the formats listed in **Table 2** can be heard on the air.

Club Callsigns

Club callsigns are issued by Ofcom to clubs. The applicant must hold a full licence and be supported by other full licence holders. This can be done through the Ofcom website. Once issued, the club has the option to use a special club prefix as shown in Table 1.

Other Callsigns

Besides the ordinary 'personal' and normal club callsigns, there are a number of other callsigns issued for use by the amateur service.

Repeaters

Analogue voice repeaters and amateur television repeaters (both analogue and digital) are assigned the prefix GB3 with a 2-letter suffix. Digital voice repeaters are assigned the prefix GB7 with a 2-letter suffix. It's worth noting that there are a few exceptions to this, particularly for units that have had digital voice facilities added to existing analogue voice facilities. Current lists of all types of repeaters can be found at:
https://ukrepeater.net

Simplex Gateways

Digital simplex gateways are units that use digital modes such as Fusion, D-STAR and DMR. They are allocated callsigns in the MB6xx and MB6xxx series. Their analogue counterparts are allocated callsigns in the MB7xxx series. As with repeaters, there are a few exceptions to this. Current lists of gateways can be found at:
www.ukrepeater.net/gateway_list.htm

Beacons

Beacons are to be found on almost every amateur band. They transmit either continuously or at a specific time interval. Those beacons authorised by Ofcom are allocated a callsign with a GB3 prefix and a three-letter suffix, such as GB3SCX. While they are mainly designed to help understand current propagation conditions, they can also be a good source of weak signals to check that receivers are working. I'll look at beacons in more depth in a future *What Next* column. It should be noted that short of looking up a received beacon's callsign, it is not possible to establish a beacon's DXCC entity because they are all allocated a GB3 prefix. Current lists of GB3xxx beacons can be found at:
https://ukrepeater.net/beaconlist.htm

Special Event

Most special event stations are allocated callsigns according to **Table 3**. They are available as a Notice of Variation (NoV) to individuals holding a current full licence or a full club licence. The NoV is valid for a maximum of 28 consecutive days. A special event station must be supporting an event of special significance, such as a celebration, anniversary or demonstration and which is open to viewing by members of the public. Applications for special event callsigns can be made on the Ofcom website.

Occasionally Ofcom will agree to issue special event callsigns outside the range listed in Table 3. These are handled manually by Ofcom for events of national significance. Many readers will no doubt recall GB100RSGB, **Fig. 1**, used to mark the centenary of the RSGB in 2013, and GB75PW, **Fig. 2**, used to mark the 75th anniversary of *Practical Wireless* in 2007.

If you are ever involved with a special event outside England, where you will be uploading logs to Club Log or other databases, I would suggest contacting the relevant system administrators so that they know which DXCC entity to associate with your GB prefix. If you are printing QSL cards, then again it is a good idea to include the DXCC entity (Scotland, Wales, and so on) so that the recipient can clearly identify the DXCC entity being confirmed by your QSL card.

Fig. 1: A QSL card from GB1000RSGB.

Fig. 2: A QSL card from GB75PW.

Fig. 3: An outline map of Spain showing the various callsign areas.

Contest

It is not necessary to use a special callsign in a contest. However, keen contesters and contest groups holding a full licence can apply for a special short length contest callsign. Those applying have to demonstrate a track record of successful contest operating. The prefixes issued are in the range of G0 to G9 and M0 to M9 with the usual regional secondary locators and just a single letter suffix (G2L, MM2A, for example). Nowadays these special contest callsigns can be used in almost all contests but RSGB contest rules restrict their use in certain national contests. Full details can be found on the RSGB website at:
www.rsgbcc.org/hf/information/scc.shtml

Foreign Callsigns

In many countries the number in the prefix indicates the regional location of the station, and in some cases the DXCC 'entity' as well. An example of this is Spain, **Fig. 3**. Here the prefixes EA1, EA2, EA3, EA4, EA5 and EA7 are allocated to mainland Spain (DXCC entity Spain). EA6 is allocated to the Balearic Islands (Majorca, Menorca, etc.), which although administratively part of Spain, are a separate DXCC entity. Likewise EA8 is allocated to the Canary Islands, also a separate DXCC entity. Finally, there is EA9, which is allocated to the Spanish North African enclaves of Ceuta and Melilla, again a separate DXCC entity. Just to confuse things, the EA0 prefix and certain other Spanish special event prefixes (in the AN series, also available to Spain, for example) have been used in any or all of these Spanish territories.

Other countries where the prefix indicates the regional location include Belarus, Estonia, Sweden, Slovak Republic, Thailand, Mongolia, Austria, Finland, Canada, Peru and Poland. The same used to be true of the USA where, for example, the prefix K6 or W6 would indicate a station in California but for many years now this has no longer been the case.

Prefix-Based Contests and Awards

The American *CQ Magazine* organises a number of major worldwide contests based around unique prefixes. During these contests a range of callsigns with less common prefixes can be worked. The same magazine also sponsors a range of awards, **Fig. 4**, based around confirmed contacts with unique prefixes.

Operating Abroad

When operating abroad, you'll need to comply with local licensing conditions. In countries that have adopted CEPT recommendation T/R 61-01 you add the country prefix to your callsign (I would sign F/G6MXL when operating in France, for example). Note that UK Foundation and Intermediate licences are not generally accepted abroad. Full licence holders wishing to operate in countries that have not signed up to CEPT recommendation T/R 61-01 but accept HAREC (the Harmonised Amateur Radio Examination Certificate) can use their HAREC certificate to apply for a local licence. I looked at operating abroad in much greater depth in the May and June 2015 issues of *PW*.

Fig. 4: A CQ Magazine Prefix Award.

Fig. 5: RSGB's Prefix Guide book.

Genuine Callsigns

There really is no way to be absolutely certain that a callsign is genuine. If the callsign is from a range issued by Ofcom, then the *RSGB Yearbook* is a good start, although it obviously won't list callsigns that have been issued since it was published. The popular QRZ.COM online callbook is another good source. If you haven't checked your entry, I would encourage you to do so, even if you exclude your address and state that you don't QSL, for example.

Just listening to the operator on the air can also be a good clue. If they use 'proper' amateur procedures, then they are more likely to be genuine. Having said that, remember newcomers may take a while to get used to good operating procedures so please don't assume that someone using a Foundation call is suspect if they get a bit tangled up!

Reference Book

While there are numerous sources on the internet that will convert callsigns or prefixes to DXCC entities (and most PC-based logging programs will also do so), I find that I refer most frequently to the *RSGB Prefix Guide*, **Fig. 5**, compiled by **Fred Handscombe G4BWP**. Updated editions are published every few years to reflect changes.

International Conflicts

In times of international disputes over pockets of land, amateurs in the locality can be in a very difficult position. A current example is the dispute between Ukraine and Russia over Crimea and parts of Eastern Ukraine. Some non-standard prefixes (D1, for example) have been heard from the area. Some international contest organisers are accepting standard Ukrainian and Russian prefixes as counting for the respective country regardless of where the station is actually located. A similar situation has existed for many years with Northern Cyprus.

Pragmatism

At the end of the day, I doubt if Ofcom are going to remove your licence if you happen to work what you believe to be a genuine callsign, which turns out not to be genuine. However, they are absolutely in their rights to throw the book at you if they can show that you are knowingly making contacts with unlicensed stations.

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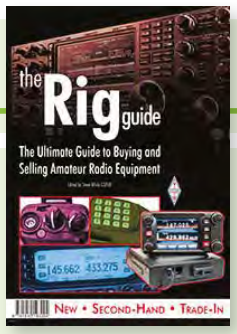

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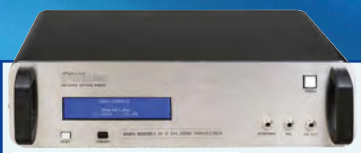

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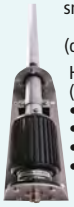

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What's happening and what's about to happen – you read it here first!

Emerging Technology

The Barrett 4075 liquid cooled amplifier.

Liquid Cooling for HF Amplifiers

We amateurs are familiar with convection cooled or fan cooled high power amplifiers, whether these be valve or solid-state. I fondly remember building a 400W PEP output solid-state amplifier using a pair of BLY90 power transistors, each having 130W power dissipation, which I mounted on a 400 x 100 x 100mm finned heatsink. Even this got fairly hot, especially during HF data transmissions, and I considered adding forced air fan cooling.

HF communication using data transmission has certainly increased dramatically over the years, not just by radio amateurs but also by government agencies such as security forces, non-government organisations (NGOs) such as aid agencies, and commercial operations such as oil exploration companies. When I'm talking of data, you may think of modes such as RTTY, PSK31, SSTV and the like. But many non-amateur HF users are gradually changing over to digital voice on HF with its ability, aided by forward error-control and auto-acknowledgement of correct reception, to get through when other modes can't. The ease of digital encryption is an added bonus for many users.

Many, many years ago amateurs knew that CW would get through when voice modes at that time couldn't but that's certainly not the case now, nor indeed has it been over the past 25-30 years or so. I fondly remember, in my main job, giving a live on-air demonstration to my amateur-licensed Sales Director around 27 years ago, of HF data on 20m one lunchtime in my office. All he could hear was simply noise and interference on the transceiver but there on the green screen of the IBM 8086 PC (with all of 125kB memory and two 5.25in floppy disk drives) was 100% correct and uncorrupted incoming text. He was, to say the least, amazed. I was very fortunate in my job by having a fully-equipped HF/VHF/UHF station in my office, along with a 6m/2m/70cm/23cm packet node and DX cluster station and roof mounted antennas – that would almost certainly have been frowned on now!

Getting back to the subject of amplifier cooling, many high power broadcasting stations have employed water cooling of their amplifiers. However, liquid cooling is now being used in commercial two-way HF radio systems. Barrett Communications, an Australian company manufacturing HF communication equipment, have recently started using a water propylene glycol mixture in their 1000W PEP output 4075 HF amplifier. They say this allows the transmitter to run continuously at optimum temperatures and reduces the requirement for forced-air cooling. They add that this is a more efficient design, consumes less power, offers greater reliability and extended service life and provides a much quieter working environment, and that the advanced liquid-cooled solid-state design of the 4075 amplifier is believed to be the first of its kind. *(Many high-end personal computers now have liquid cooling too, to get heat away from the main processor chip. I know of at least one radio amateur who has used such a module for cooling a homebrew amplifier – **ed**.)*

Emerging Technology in UK Amateur Repeaters

I've been fortunate enough to be able to support emerging technology in amateur repeaters for over 35 years, being a founder member of a number of repeater groups as well as being, later, a technical committee member and engineer for Britain's first repeater, GB3PI, Britain's first 70cm repeater GB3PY and Britain's first RTTY and Data repeater GB3PT, along with establishing 23cm TV repeater GB3PT together with my colleague **Godfrey Spires G4XHM**, now sadly deceased, as well as getting 23cm repeater GB3PS on air. Interesting challenges to say the least!

In those days it really was up to individuals and groups to pioneer such projects but for some time now we've had significant help in co-ordination and technical assistance. Many amateurs are unaware of the RSGB (Radio Society of Great Britain) Emerging Technology Coordination Committee (ETCC), who aim to develop and enhance the UK amateur radio repeater and data communications systems and promote the introduction and rollout of appropriate new technologies. From 1999 to 2007 one of the ETCC's predecessors, the Data Communications Committee, acted as the body responsible for facilitating, by means of frequency coordination, simplex internet voice gateways. At the time of writing there are operational gateways on 51MHz, 70MHz, 145MHz, 430MHz, 431MHz, 435MHz and 1297MHz. Full details of the currently licensed gateways plus the online Notice of Variation (NoV) application system can be found on the ETCC's website: **https://ukrepeater.net**

Also, you will find links to popular Voice over IP (VOIP) software packages and information that can be downloaded. I hope this is of use to readers interested in emerging amateur radio technology.

Ready Steady Go Backwards

With no pun intended whatsoever to the RSGB for the title, emerging technology doesn't always lead to faster over-air data rates. Many of us know of POGSAG (Post Office Code Standardisation Advisor Group) paging that has been used commercially throughout the world for paging, including life-dependent paging for medical staff and organisations such as the RNLI. The modulation used is FSK (Frequency Shift Keying) with a ±4.5kHz shift on the carrier, and used with a 25kHz channel spacing or in some countries on 12.5kHz channel spacing with ±2.5kHz shift. It was developed back in the 1970s and was adopted by the CCIR (Comité Consultatif International pour la Radio, the forerunner of the ITU-R) as Radiopaging Code No.1. It's still used worldwide for both numeric and text paging.

Now you may think new technologies, such as TETRA (TErrestrial TRunked Radio) as currently used by the UK 'blue light' emergency services, with its TETRA paging facility and belt-worn TETRA pagers, would be better than this. Not so! A recent Swissphone white paper compared POCSAG, TETRA and LTE (Long Term Evolution). The white paper came up with two main findings. The first was that POCSAG gives the very best and most cost-effective in-

door coverage, which is vital in places such as hospitals and, say, the homes and workplaces of RNLI volunteers. Indeed, a recent newspaper article reported that 90% of remaining BT pagers in the UK are in use by the NHS.

It also found that POCSAG paging provides a higher reserve in-link budget than LTE, TETRA voice radios and TETRA pagers. The 7 to 10dB improvement in link budget compared with TETRA pagers corresponds to an area coverage that is five to ten times greater. In other words, a POCSAG base station realises the same radio coverage as five to ten TETRA base stations in a network used for alerting. They then concluded that a POCSAG base station was more cost effective than a TETRA base station by a factor of 15 to 30. Therefore, it was generally easier and less expensive to build the required indoor coverage with POCSAG than with any other alerting technology available. They also found that building a POCSAG network for alerting in parallel to TETRA saves money, even if a TETRA network already exists. POCSAG pagers are also as much as three times more cost effective compared with TETRA pagers. Given the large numbers of pagers required, the difference in price outstrips the cost of the separate POCSAG network. Again, the difference in link budget margin between TETRA pagers and TETRA radios is important. Even if a network offers full indoor coverage for TETRA radios, it will require twice or even four times as many base stations to achieve the same coverage for TETRA pagers. Emerging technology doesn't necessarily always bring technical and operational benefits!

Youngster Newcomers – Our Emerging Technology Future

Some years go, my neighbour **Nigel Phillips**, who was the CDT (Craft Design and Technology) master at the Cantell School in Violet Road, Southampton, asked me whether his class could pay an industrial visit to my firm's factory in Chandlers Ford, Hampshire, where we manufactured radio communication equipment as well as having, at that time, a string of amateur radio retail shops throughout the UK. A quick chat with my amateur-licensed MD, **Barry Gardner**, gave the 'all clear' and a tour was arranged. The 20+ pupils had a useful conducted tour around the factory and we concluded in our large conference room where they sat down and were treated to packets of crisps and tins of soft drinks while they watched a large-screen promotional video of amateur radio and its benefits to youngsters. Unfortunately, to my mind at least, this was

The Mir space station.

heavily biased in the favour of Morse Code rather than any new technology.

After the pupils had watched the video, and with me giving them an invitation to study part-time at school for the Novice Licence, Nigel asked if any were interested. One boy very sheepishly raised his hand. Nigel then asked if there were any questions. A young lady pupil raised her hand and asked, *"Do we have to learn Morse code?"* I immediately replied, *"No, of course not, there's no need whatsoever for the Novice licence, you can use voice, data communication such as packet radio, and lots more."* The pupils were certainly interested in data and were surprised to find that, unlike the internet, there were no charges at all, not even for their licenses. To cut a long story short, all six pupils who took the twice-weekly course that I prepared and ran as a volunteer, passed and achieved their licences and thanks to the generosity of **Rob Taylor G4ROB** of Anchor Supplies in Nottingham, each was presented with an ex-government 70cm Pye PF2UB 3-channel UHF portable transceiver together with a copy of my *PMR Conversion Handbook* with conversion information. With our help they each got going on 70cm FM and I established a 70cm repeater at the school, **GB7EA** (Eastleigh), along with a 2m repeater **GB3SH** (Southampton). Nigel also became **G7POC** and is now an active member of the current repeater group. I also donated a 2m synthesised base station and a low power HF station along with antenna systems to the school for the pupils' use.

The newly-licensed pupils were subsequently delighted to have communication via packet radio with **Musa Manarov UA9EV**, Hero of the Soviet Union, who was on board the orbiting Russian Mir ('Peace') space station. He even sent the students an RTTY-like block diagram over packet of the space station, with a description and showing the Kvant module were he resided. To put it mildly, the pupils were delighted and I'm sure many of them went on to have successful careers in emerging technology.

On a personal note, when I was also a young schoolboy in Lancashire, my parents saw me soldering components together in my bedroom to make a basic radio receiver. At that time my father was a Spinner in a Lancashire cotton mill and my mother was a Weaver at the same mill. They said to me, *"If you carry on like that, you'll end up working in a factory"*. Yes, I did carry on – I ended up with a first class honours degree in Electrical and Electronic Engineering and became a team leader in the two-way radio design laboratory of a large factory in Cambridge, with an international patent for antenna matching technology to my name. Later I ended up as Chief Technical Officer (CTO) in a factory of an international group of two-way radio communication manufacturers and suppliers, with over 95% of our products boosting UK exports, including 35,000 radios for police and border control security in Afghanistan, along with a further international patent application to my name for antenna technology. That all started with a youngster pursuing his hobby despite derision from others.

We owe the future of our hobby to promoting interest in emerging technology in our up-and-coming youngsters. Never mind, *"Pass the Port, Rodney, isn't it good that we're keeping all these young upstarts away from our hobby"*. When I was a youngster with my callsign of G8IYA, I was asked on the air, *"When are you going to get your 'proper' licence?"* meaning a Class A. The G3 amateur who was using commercial equipment also asked if the 2m synthesised FM rig I was using was a *"Japanese black box import"*, to which I quite honestly replied that I was part of the UK team that designed the transceiver and that I had built it myself over a weekend from scratch component by component. Yes, I did gain a Class A callsign, taking the Morse test in secret one day in Liverpool and simply appearing on the bands one morning as G4HCL to the surprise of my on-air friends. The eventual Novice licence, proposed to the Radiocommunications Agency (the RA, later Ofcom) by **Ian Abel G3ZHI** and adopted by the RA who acknowledged Ian as the proposer**,** like it or not literally doubled the number of licensed amateurs in the UK and certainly boosted youngsters' interest in our hobby.

Once again, we owe the future of our emerging amateur radio hobby, including digital over-air technology along with internet-linking, to our up-and-coming youngsters. We should help and encourage them, not depress and ridicule them. Enough said.

See you soon as I explore the future on behalf of PW readers. Chris G4HCL.

Don Field G3XTT E-mail: practicalwireless@warnersgroup.co.uk

GB2RN and HMS Belfast

Editor Don Field G3XTT reports on a recent visit to HMS Belfast and GB2RN.

HMS Belfast, photo courtesy IWM.

Don G3XTT gets to operate GB2RN.

HMS Belfast is docked near Tower Bridge and was opened to the public in 1971 by the Belfast Trust charitable trust. Nowadays it is run as a branch of the Imperial War Museum (IWM). Among the many other features of interest on board is a permanent amateur radio station, callsign GB2RN. Your editor was invited to visit and see what the ship and the station have to offer. I finally managed to do so this summer, in company with my daughter **Helena** and granddaughter **Caitlin**. It proved to be an excellent day out.

HMS Belfast

There's lot of information about HMS Belfast on the IWM website, as you'd expect. Briefly, the ship has a long and distinguished history, having been launched in March 1938, served in WWII, including leading the fleet on D-Day, seeing action in Chinese waters when the European war had ended and being heavily involved in the Korean War in 1950-52. She remained in service until 1962, undertaking a number of exercises and official visits around the world.

With the aid of lifelike reconstructions, these days the ship tells the story of life on board and explores how war affects and impacts on the morale, resilience and determination of the ship's community. There are nine decks in all (the ship had a crew of 950) and my family and I were astonished at the sheer scale of everything, from the size of the boiler and engine rooms to the gun turrets, accommodation, kitchen and so on. The ship was a floating town with its own workshop, hospital, dental surgery, shop, laundry, brig (cells for prisoners) and much more.

Because this was the Admiral's flagship, there are two bridges, the Captain's bridge and the Admiral's bridge. There were three radio rooms in all, the Admiral's radio room (for sending commands to other vessels in the fleet, where GB2RN is now located, the ship's regular radio room and a radio room specifically for the control of gunnery.

GB2RN is Established

A history of GB2RN can be found on the GB2RN website (below). In essence, the Royal Naval Amateur Radio Society (RNARS) was invited, early on in the restoration of the Belfast ready for its opening as a museum, to be involved specifically in the refitting of the wireless offices. **Wally Walker**, a radio amateur but still serving in the Navy, was seconded to the HMS Belfast Trust and was given the necessary authority to tour various naval stores to requisition returned radio equipment and ancillaries. It was Wally who also suggested to the Admiral in charge of the Trust at that time that a permanent amateur radio station would be an asset. This was agreed.

www.gb2rn.org.uk

To help things along, the RNARS London Group was formed in 1973, with **Don Walmsley G3HZL** as Chairman. Its remit to was to help with the establishment and running of the amateur radio station.

Thus GB2RN was established although in the early days its operations were conducted by radio amateurs who were still serving in the Navy and who were required to conduct operations while in uniform.

Above left: One corner of the GB2RN shack with the VHF operating position and lots of historic gear. Above right: A collection of B40 receivers.

GB2RN Now

GB2RN has become well established over the years and continues to be run and operated by members of the RNARS London Group although visiting amateurs are welcome to operate the station, preferably by prior arrangement (and do bring a copy of your licence!). There are four operating positions available. There is range of Yaesu kit for HF and operation, including an FT-847 (used mainly for 2m) and an FT-1000MP MkV Field. A selection of old Navy gear is also on display alongside several historical items from other navies, particularly the USA.

Two doublet antennas are installed between the upper yardarms of the masts, 22m above the deck, high above the River Thames and tuned remotely by LDG AT-100 Pro II auto-ATUs housed in waterproof cases at the foot of the forward funnel. The VHF antenna is a triband (6m/2m/70cm) collinear.

A team of volunteers keep the station on the air during visiting hours. The aim is to have two operators on duty at any one time, one to operate the radio and the second to explain to visitors what is going on. There is also a Morse key and sounder and young visitors are encouraged to try their hand at sending their name in Morse code, on completion of which they receive a nice certificate.

Our Visit

On the day of our visit the station was manned by husband and wife team **Chris G0EKN** and **Stella G0EKP**. There was also a visiting amateur from the London area who was busy on 2m so either Stella or Chris was able to deal with visitors while the other operated HF.

Admittedly our visit was during the main holiday season but I was taken with the steady stream of visitors to the radio room and the level of interest shown. During our time there we saw folk from Israel, Japan, South Africa and other exotic parts of the world as well as from the UK. The GB2RN volunteers, though, see London as a key part of their constituency and are always keen to work local amateurs on HF or VHF – who knows, some of them might join up and help out in due course.

Membership

Apropos of which, membership of the RNARS London Group costs £10 per annum and, at the discretion of the Committee, is open to all radio amateurs and shortwave listeners. Details of how to join appear on the GB2RN website. There is also a GB2RN presence on Facebook with plenty of current news, photographs and other related material.

Visiting

HMS Belfast (and GB2RN) are open 364 days of the year. Details of times, prices, how to get there and so on are on the HMS Belfast website.

www.iwm.org.uk/visits/hms-belfast

As a word of caution, HMS Belfast is not a cruise ship! Getting between decks requires going up and down lots of steps, mostly in the form of rather steep metal companionways, albeit with handrails. There are also some quite narrow walkways, for example in the engine room between the various pieces of machinery. My seven-year-old granddaughter

Caitlin prepares to send her name in Morse.

managed it all with no problems at all but I'm glad my wife didn't come on this particular visit, given that she was suffering some back problems at the time. In terms of how long to allow for a visit, all I can say is that however long you allow, you probably won't get round the whole of the ship in a single visit!

Thanks

My thanks to **Doug Goodison G0LUH** and the GB2RN team for their hospitality during our visit and to **Poppy Andrews** of IWM for helping with background information.

Steve White G3ZVW • E-Mail: practicalwireless@warnersgroup.co.uk

Maximum Usable Frequency

In this instalment Steve White G3ZVW looks at Maximum Usable Frequency.

The last instalment of *Making Waves* was about Critical Frequency (foF2) and Near Vertical Incidence Skywave (NVIS) propagation. Those topics lead neatly on to the subject of Maximum Usable Frequency (MUF).

Constant Change

Constantly changing solar conditions and the amount of energy reaching various parts of the ionosphere mean that, just like foF2, the MUF is in a constant state of change. Rather like foF2 it is fair to say that the MUF is usually higher in the tropics than it is near the North Pole or South Pole, and it is also likely to be higher around the middle of the day than it is at other times (and especially at night).

Prove it to Yourself

First, go to the ionospheric page of the Convective Weather website at: **www.convectiveweather.co.uk/ionosphere**

Click on the Live data link. You should see an image similar to the one shown in **Fig. 1**, which gives figures for the MUF for various distances, plus the Critical Frequency (foF2). Fig. 1 is from September 2nd, if you want to search for it in the Archive section. I have added some markers and text to the figure, which I'll now explain.

Starting at the bottom, the MUF (the red line) at 13:30 hours was 5.5MHz. At exactly the same time the MUF for a 3,000km path (the yellow line) was 17.9MHz. That's a whopping 12.4MHz difference, so let me explain exactly what's going on here. foF2 is associated with signals going straight up and then coming back down, whereas MUF is associated with signals being refracted at a shallow angle. Remember, I said before that the ionosphere is much more likely to be transparent overhead but act like a mirror at the horizon. But it is frequency dependant. In between the two I have circled the MUF for a 1,000km path. At that time it was somewhere between the two, sitting at 8.5MHz.

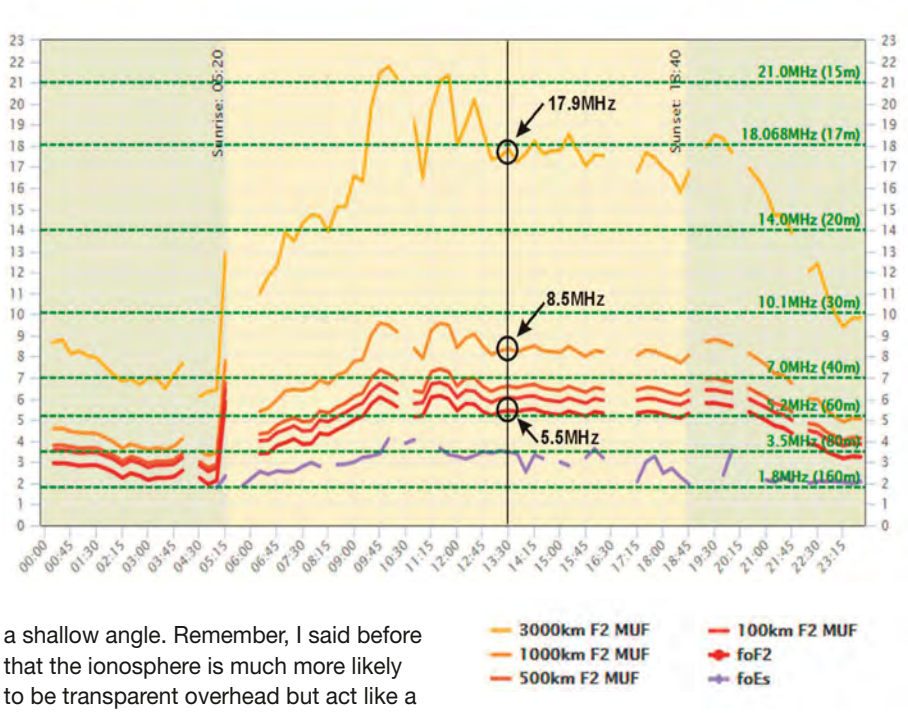

Fig. 1: The Maximum Usable Frequencies and Critical Frequency at 13:30 on September 2nd 2017 at the Fairford ionosonde.

Another way of proving it to yourself is to listen on the various amateur bands. At night the MUF drops, so bands such as 14MHz, which are open for long distance working during the day, are not at night. You can see this clearly in Fig. 1. On September 2nd the yellow MUF line for a 3,000km refraction is above the green dashed line for 14MHz from about 07:30 to 22:00. Bear in mind, though, that you should not expect a refraction up to 3,000km in all directions at all times.

What it Means

Assuming an F Layer height of 300km, the absolute maximum distance a radio signal can be refracted back to Earth from the ionosphere is about 4,000km (2,500 miles) but the web page shows the longest distance MUF for a 3,000km path. 3,000km (about 1,900 miles) is more realistic, because it is difficult even for Short Wave broadcasters to fire the majority of a transmission at zero degrees above the horizon and thereby get a refraction at the absolute maximum distance. Broadcasters have large, optimised antenna systems, so it's even more difficult for radio amateurs to do it! Also, the height and intensity of the F2 Layer varies, so the refraction point (if there is one) isn't constant.

There's something else we also need to consider and that is that we don't always

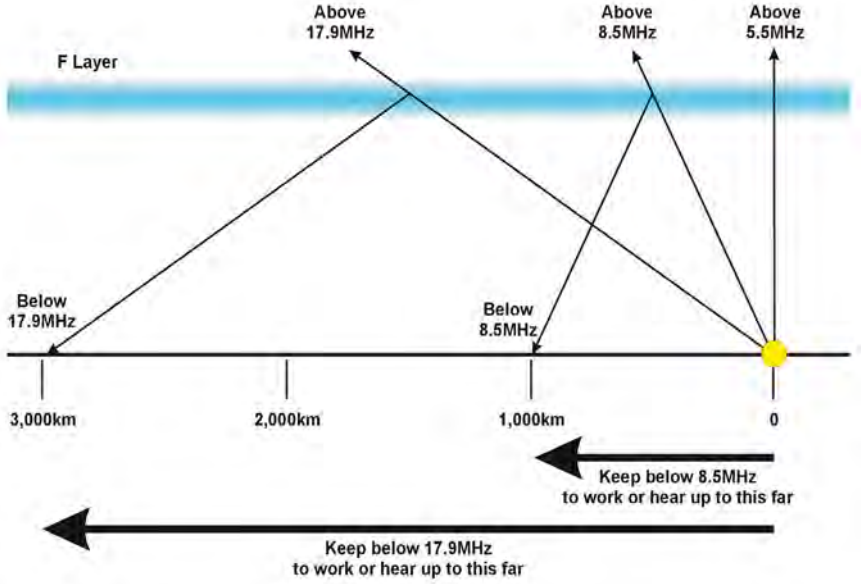

Fig. 2: Frequencies that will be refracted (or pass through) at various distances.

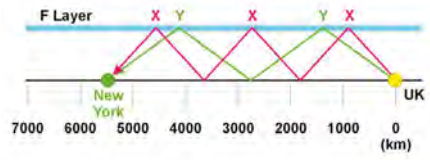

Fig. 3: Two and three hops of the ionosphere to New York. Maybe both at the same time!

want to hear people or make contacts at the maximum possible distance. Most of Europe is a lot closer to Britain than 3,000km, so the website also shows the MUFs for shorter distances. I chose to highlight the 1,000km line but 500km and 100km are also shown in Fig. 1. In **Fig. 2** I show how those figures translate into the real world, by showing what frequencies are going to pass through the F Layer and which ones will be at least partly refracted by it.

Multiple Hops

First, here are a couple of facts:

The absolute maximum distance a radio signal can be refracted back to Earth from the F2 Layer of the ionosphere is about 4,000km (2,500 miles).

New York is about 5,500km (3,400 miles) from the middle of the UK.

These things being so, you don't need a qualification in maths to work out that you cannot get a radio signal from the UK to New York in one hop. It is entirely normal though for long distance propagation to occur via multiple hops. New York would normally be two hops, but we should not ignore the possibility that it could be more and, indeed, that the signal could arrive by more than one path and from more than one angle.

In **Fig. 3** I have flattened the Earth, added a scale and show what is likely to be happening. The height of the ionosphere isn't to scale but what I hope it shows is that the two-hop path to New York is via a lower angle (the green line, with refractions at the points marked Y) than the three-hop path (the magenta line, with refractions at the points marked X). Something I don't show is that I am assuming the signals travel between the end points in a straight line. Most times they do but sometimes they don't.

Something else to think about is what happens to signals when there are multiple hops. I have said that a signal needs to be refracted back to earth from the ionosphere but it also needs to be reflected by the ground. On its journey across the Atlantic a signal will be reflected by the surface of the ocean. Saltwater is quite conductive so it isn't a bad reflector. Consequently, a fair percentage of the signal is likely to be propagated onwards. The same cannot be said of the land, which isn't such a good reflector because it isn't as conductive. Signals to the Far East have to go across the Asian landmass so generally speaking, stations from that part of the world are not received as strongly in the UK as signals from the Americas, even though they may be similar distances away.

Possible Confusion

If you are a VHF user, you could easily be forgiven for thinking that if the MUF is, say, 15MHz, you will not be able to make any contacts or hear anything above that frequency by anything other than Ground Wave propagation. This is not the case and it's because the MUF is associated solely with the F Layer of the ionosphere. If you communicate via a different mode of propagation, the MUF figure doesn't apply – and there are plenty of instances of that.

On the upper HF bands (21-28MHz) and on VHF there will be plenty of times when one or more of those bands will be open for long distance communication while the MUF is way below them. In the Summer – and to a lesser extent in the Winter – Sporadic E propagation is responsible for that. This is a topic I covered in the May 2017 instalment. There are also several long distance propagation modes that are pretty much exclusive to VHF, such as meteor scatter and tropospheric ducting (not yet covered).

Summary

The MUF is something useful to think about for long distance HF working. To stand a chance of getting a single-hop signal through up to 4,000km, the MUF needs to be above the frequency you wish to use at the refraction point (half way between yourself and the other end of the radio path). Similarly, for longer distances the MUF needs to be above the frequency you wish to use at each of the refraction points, otherwise the signal may refract at the first but escape out into space at the second/third.

Commercial Short Wave broadcasters often choose a working frequency of about 90% of the MUF, because it can then change a bit before they need to think about moving to a different frequency. Simply put, it makes scheduling a practical proposition. Commercial broadcasters subscribe to propagation predictions and know what frequencies to use at the various times of day, seasons of the year and parts of the 11-year Solar Cycle. Most of the time, anyway! Perhaps most importantly though, they don't usually try to beam signals right across the world. The BBC, for example, has a shortwave relay station in Singapore to cover the Far East and on Ascension Island in the South Atlantic to cover Africa and South America. They used to have relay stations on Cyprus and in the Seychelles too, but they closed down in 2013/2014.

Letters

Send your letters to:
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Callsigns and Emerging Tech

Dear Don,

Dave G1VAC (*Letters*, October), apparently cannot understand why some people have multiple callsigns? Well, there is a simple answer to that question in my case. Just like Dave who is obviously proud of one callsign, I am proud of two. Although, as Dave so succinctly puts it, *"it's only possible to use one callsign at a time so why does anyone need more?"* However, putting to one side that many people insist on owning two or three cars but can only drive one at a time, has he temporarily forgotten that many amateurs have multiple callsigns because not only do they have a UK callsign but also have an overseas callsign too?

Contrary to **Tony G1YIL's** comments in the same *Letters* pages, emerging technology doesn't take a great deal of imagination to predict. As far as the internet is concerned, for those that can still remember bulletin-boards, the beginnings of e-mail and so on, it was as plain as a pikestaff what it would eventually morph into. And smartphones, given what was being surreptitiously developed in several R&D labs, particularly in America (I knew a man who knew a man who worked in one of them), would inevitably pop up a few decades later. DVD players were another obvious leap forward. **Arthur C Clarke's** proposition of three geostationary satellites although a good idea, at the time, was fatally flawed because of what you point out in your comment. But, of course, the annoying time delay versus distance problem is being worked on at this very moment. Then, we can watch sport wherever. Literally. Without any buffering or delays.

Ray Howes G4OWY/G6AUW
Weymouth, Dorset

Editor's comment: *Thanks Ray. Well, I have three callsigns – my UK callsign, my short contest callsign (it supposedly helps to increase rate in contests, although I have yet to be fully convinced!) and my US callsign. I've held lots of overseas callsigns over the years, for my various DXpeditions and holiday trips, but the US one I consider to be long-term, simply because I visit quite regularly. Apropos smartphones, though, I will never forget reading an article in* Scientific American *by a learned professor (Harvard or whatever) about how the telcos were going to be putting all sorts of applications into their networks. Obviously that was in their commercial interest but Apple pulled the rug from under their collective feet by putting the apps in the phone itself! The rest, as they say, is history.*

It's Not Technology

Dear Don,

As a 57-year old, I have a lot of sympathy with **Rick Roderick K5UR's** comments (October *Keylines*) because my view is similar. Having been licensed for 27 years, I too have never had any interest in contesting or what many regard as the traditional aspects of the hobby. I too have always seen it as a method of communication and, over the last dozen years, particularly digital communication. That means I still experiment with antennas and equipment, look into the opportunities for different propagation modes across the various frequency bands, do the odd SOTA activation or reply just to try it out. I've been involved in RAYNET where, again, radio is used as a means of communication rather than as an end in itself.

I passed my City and Guilds licence exam while completing engineering training with the BBC and have been involved in professional radio engineering ever since. Contesting is a great and hard earned skill and shows prowess in operating but it has little to do with the development of tomorrow's engineers.

Many thanks for yet another excellent issue of *PW*.

Phill Gardiner G8YLX
Barnsley, Yorkshire

Proper CW?

Dear Don,

I was somewhat dismayed by **Bob G3XNG** declaring in **Roger Cooke G3LDI's** *Morse Mode* column, *"Next, if you can't send proper CW, don't go on air until you can".* To compound matters further he qualifies this by stating, *"He'll soon be in a crowd of one and my log reads that I should avoid him in future".* The poor chap who was having difficulty during this QSO must be feeling awful after reading this. Quite possibly, the amateur concerned has some difficulties and finds Morse quite challenging. Rather than send him to the sin bin for not sending 'proper' CW, wouldn't it have been more appropriate to help the amateur rather than berate him via the *PW* column. As an analogy, I have spoken to amateurs with speech problems that I have patiently worked through, congratulating them at the end of the QSO, and would never dream of making a remark in my log to 'avoid in the future'.

I have the fullest admiration for the amateur in question and if he reads this, please be aware that the 'avoid in the future' list is the exception, if not unique, being totally bigoted while also running contrary to the amateur ethos, which is surely to help and guide others. Maybe in this instance others who feel the same may place G3XNG on their own 'avoid in the future' list, knowing that if you don't send 'proper' CW, the wrath may fall on you too. A very sad paragraph indeed while also a bad day for amateur radio. If you feel you don't send 'proper' CW, please don't let this put you off – there are lots of proficient helpful friendly amateurs out there to guide you along. Remember, there will always be greater and lesser out there.

Neil Thackrey EA7VPG/GM0VPG
Malaga, Spain

Editor's comment: *Thanks Neil. I was somewhat taken aback by that comment too. After all, our hobby is surely about self-training and having a transmitting licence is so that we can do exactly that, whether it's to try out a new transmitter that we have home-brewed or practice (and improve) our operating skills. I well recall my own early faltering Morse QSOs. I may not have stuck with it except for the patience of the late* ***Lionel Parker G5LP****, father of the current holder of that callsign (also* ***Lionel****), who lived just a few miles from me and with whom I had my first few on-air Morse contacts.*

Please note: The opinions expressed in any letter published in PW are those of the named correspondent whose letter has been published and they don't necessarily reflect the opinions of the editorial staff or Warners Group. **Editor**

£20 STAR LETTER

Tales of Royalty

Dear Don,

I see from your latest *Keylines* that you are looking to hear interesting stories regarding overseas royalty.

Back in the 1990s, I received a phone call telling me that I was off to Saudi Arabia that same day. My driver, **Mike**, took my passport to the London Saudi Arabian embassy for my visa to be prepared while I went home to pack my bag. I was to visit the Saudi GID (General Intelligence Division) to plan a covert radio communication system for their secret agents.

My driver was very well looked after at the embassy, with coffee and dates, and was soon given my passport with visa. Before he left, the embassy gentleman wrote his telephone number and a few short phrases in Arabic on a scrap of paper, tore it off and said, *"If there's any problems with the visa, please let me know".* So I went to Heathrow for my overnight flight, my suitcase with my clothes and my hand baggage with personal effects and housing the several 'spy' radios, including wireless earpieces and similar.

On arrival at Riyadh airport the following morning, my baggage was searched, of course, hand baggage first, and once the security personnel found the covert two-way radios I was immediately surrounded by machine-gun toting officers, about to put the manacles on my feet and take me away. I remembered the note, which was in the top pocket of my shirt, proffered this to the officer and said *"Min Fadlack"*, Arabic for *"please".* There was an immediate look of horror on his face, the other staff immediately re-packed my hand baggage, didn't bother searching my suitcase and in perfect English said *"Please go, please, please go".* It turned out that the Arabic note was from one of the Crown Princes of Saudi Arabia, saying that I was providing valuable anti-terrorist help to the country and to offer me every assistance.

A few days later, I was invited to the 'humble home' of **Ziad Al Sheikh HZ1ZS** (HZ1 Ziad Sheikh) for an evening meal. He was a regular reader of my articles in amateur radio magazines and had heardthat I was in Riyadh. The 'humble home' was, as you may have guessed, an absolute palace with servants aplenty and a large tower-mounted rotatable log-periodic Yagi outside. We had a great meal, sitting on the floor eating with our right hands, and after the meal he offered me the sheep's eyeballs. I very politely and discreetly declined, saying that I really wasn't keen on them. He replied that neither were the Saudis but every time they offered them to the British we enthusiastically ate them!

Sheikh Ziad then offered me the opportunity to use his significant amateur radio station, which I gladly accepted. I asked what callsign I should use because, of course, I couldn't use my own. *"No problem"* he said, *"Just use mine".* After only ten minutes on air on 20m SSB I was called on my frequency by a Saudi government station, asking me who I was and what I was doing. Sheikh Ziad said, *"Just let me take the microphone".* After a few words over the air in Arabic, he said to me, *"Please carry on, they will not bother you again!"*

The following morning I received a phone call in my hotel room, from the same government department who obviously found where I was staying. *"We are sorry effendi, we have wronged you, how can we right this wrong? Please would you like to be our guest camel racing this afternoon".* I again politely declined!

Chris Lorek G4HCL
Whitby

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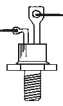

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Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

OCTOBER

October 21st (Saturday)
The Carrickfergus Rally
The Carrickfergus Amateur Radio Group Rally will be held at Downshire Community School, Downshire Road, Carrickfergus BT38 7DA. The doors will open at 11.00am and admission will cost £3.00. Light refreshments and facilities for the disabled will be available
Elizabeth Forde
E-mail: elizabethforde64@yahoo.com

October 28th (Saturday)
The BRARS AGM
The British Railways Amateur Radio Society will be holding its annual general meeting in a private room at The Brunswick Inn, 1 Railway Terrace, Derby DE1 2RU, which is almost opposite Derby railway station car park. BRARS members are welcome to arrive from midday for those who wish to have a meal and/or chat. The AGM will commence at 1.15pm and all BRARS members are encouraged to attend. Membership of BRARS is open to anyone who has an interest in amateur radio and rail transport. For more information, please contact the BRARS Secretary.
Ian Brothwell G4EAN, 56 Arnot Hill Road, Arnold, Nottingham NG5 6LQ.
Tel: 0115 926 2360
E-mail: g4ean@brars.info
www.brars.info

NOVEMBER

November 5th
The Bush Valley Radio Rally
The Bush Valley Radio Rally will be held at the United Services Club, 8 Roe Mill Road, Limavady BT49 9DF. The doors will open at 11.00am and admission will cost £3.00, which includes a free draw ticket. There will be talk-in on 145.400MHz, trade stands, a Bring & Buy and refreshments will be available on-site. Tables are free but should be booked in advance.
Jack
Tel: 07885 292545

November 5th
The Kempton Rally*
The West London Radio & Electronics Fair will be held at Kempton Park Racecourse, Staines Road East, Sunbury-on-Thames, Middlesex TW16 5AQ. The doors will open at 10.00am (9.50am for disabled visitors). There will be talk-in, free on-site car parking, trade stands, a Bring & Buy, lectures, special interest groups, a prize draw, on-site catering and facilities for the disabled.
Paul M0CJX
Tel: 0845 1650351
E-mail: info@radiofairs.co.uk
www.radiofairs.co.uk

November 10th (Friday)
The Tynemouth ARC 'Good' Junk Sale
Tynemouth Amateur Radio Club will be holding a 'Good' Junk Sale at St. Hilda's Church, Stanton Road, North Shields, Tyne & Wear NE29 9QB. The event is associated with a regular club night, which starts at 7.00pm and is open to all, not just club members.
E-mail: mail@g0nwm.com
www.g0nwm.com

November 11th (Saturday)
The Fog on the Tyne Rally
The Angel of the North Amateur Radio Club will be holding the eighth Fog on the Tyne Rally at Whitehall Road Methodist Church Hall, Whitehall Road, Bensham, Gateshead NE8 4LH. The doors will open at 10.30am and admission will cost £2.00. There will be car parking (entrance on Whitehall Road), trade stands, a Bring & Buy, an RSGB bookstall and catering will be available (bacon butties and a cup of tea or coffee for £2.50). In addition, there will be enrolment for Foundation, Intermediate and Advanced Examination courses and Morse class.
Nancy Bone G7UUR
Tel: 07990 760920
E-mail: nancybone2001@yahoo.co.uk
www.anarc.net

November 18th (Saturday)
The RADARS Traditional Radio Rally
The Rochdale and District Amateur Radio Society Traditional Radio Rally will be held in St Vincent de Paul's Church Hall, Caldershaw Road, off Edenfield Road (A680), Norden, Rochdale OL12 7QR. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.50 (under 12s free). There will be talk-in on S22 (145.550MHz), ample parking, trade stands (junk, commercial, amateur radio and others), a Bring & Buy and catering (coffee, tea, soft drinks, bacon/sausage butties, biscuits and crisps) will be available. Tables can be hired from RADARS (£5.00 per table). Pitches cost £5.00 each or £10.00 for a pitch and a table – please book your pitch at least two weeks before the event. Traders will have access to the venue from 8.00am (7.00am for RADARS members). The event usually finishes at around 3.00pm.
Dave G3RIK
E-mail: rally@radars.me.uk
www.radars.me.uk

November 19th
The CATS Radio & Electronics Bazaar
The 40th Coulsdon Amateur Transmitting Society Radio & Electronics Bazaar will be held at the Oasis Academy Coulsdon, Homefield Road, Old Coulsdon, Coulsdon CR5 1ES. The doors will be open between 10.00am and 1.00pm and admission will cost £1.50. There will be free parking, trade stands, a Bring & Buy (10% commission), a flea market, refreshments and facilities for the disabled.
Andy Briers G0KZT
Tel: 07729 866600
E-mail: bazaar@catsradio.org
www.catsradio.org

November 19th
The Plymouth Radio Club Radio Rally
The Plymouth Radio Club Radio Rally will be held at Harewood House, The Ridgeway, Plympton, Plymouth PL7 2AS. The doors will be open between 10.00am (9.50am for disabled visitors) and 2.30pm and admission will cost £2.00. There will be ample car parking, trade stands, a Bring & Buy, special interest group, an RSGB bookstall, a prize draw, on-site catering and facilities for the disabled.
David Beck 2E0DTC
Tel: 07777 664822
E-mail: d.beck123@outlook.com
www.radioclubs.net/g3prc

November 26th
The Bishop Auckland Rally
The Bishop Auckland Radio Amateur Club Rally 2017 will be held at Spennymoor Leisure Centre, 32 High Street, Spennymoor, Co. Durham DL16 6DB. The doors will open at 10.30am (10.15am for disabled visitors) and admission will cost £2.00 (under 14s free with an adult). There will be talk-in on S22, car parking, trade stands, a Bring & Buy, family attractions, catering, a licensed bar and facilities for the disabled. The venue is described as ideal for both traders and disabled visitors, offering good parking and easy access to the large ground floor hall.
John G4LRG (Rally Organiser)
Tel: 01388 606396
Brian G7OCK
(Deputy Rally Organiser)
Tel: 01388 762678
barac.org.uk/rally

DECEMBER

December 2nd (Saturday)
The Reading DX Meeting
The Reading International Radio Group will be meeting in the Large Hall at Reading International Solidarity Centre (RISC), 35-39 London Street, Reading RG1 4PS. The Meeting will take place between 3.00pm and 5.30pm and will offer an opportunity for those interested in listening to broadcasters from around the world on the short wave, medium wave and FM bands to get together.
Mike Barraclough
Tel: 01462 643899
E-mail: barraclough.mike@gmail.com

December 2nd (Saturday)
The South Lancs ARC Winter Rally
The South Lancashire Amateur Radio Club will be holding its Winter Rally at Bickershaw Village Community Club, Bickershaw Lane, Bickershaw, Wigan WN2 5TE. The doors will open at 9.30am and admission will cost £2.50. There will be car parking, trade stands, a Bring & Buy, displays, special interest groups, a licensed bar, catering and facilities for the disabled. A limited number of pitches will be available (£8.00 if you bring your own table, otherwise £10.00) and stallholders will have access to the venue from 8.00am.
Jason G0IZR
Tel: 01942 735828 (Bookings)
E-mail: rally@slarc.co.uk
www.slarc.co.uk

December 7th (Thursday)
The SBARC Winter Table Top Sale
The South Bristol Amateur Radio Club Winter Table Top Sale will be held at Novers Park Community Centre, which is at the rear of 124 Novers Park Road, Filwood, Bristol BS4 1RN. It is described as, "A chance to clear some items from the shack and pick up new items or fill that wish list. Please bring equipment, cash and your bartering skills." The event is associated with a regular club night, which starts at 7.30pm and is open to all, not just club members. The sale will take place between 8.00pm and 9.00pm – no trading before 8.00pm.
www.sbarc.co.uk

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While prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non-current issues of the magazine.

ORDER FORM FOR CLASSIFIED ADVERTS

PLEASE WRITE IN BLOCK CAPITALS

The prepaid rate for classified advertisements is 42 pence per word (minimum 12 words), box number 70p extra. Semi-display setting £13.90 per single column centimetre (minimum 3cm). Please add 20% VAT to the total. All cheques, postal orders, etc., to be made payable to Warners Group Publications. Advertisements, together with remittance, should be sent to the Practical Wireless Classified Adverts, Warners Group Publications, West Street, Bourne, Lincs PE10 9PH.

Please insert this advertisement in the ..... issue of Practical Wireless (if you do not specify an issue we will insert it in the next available issue of *PW*) for ..... insertion/s. I enclose Cheque/P.O. for £.....(42p per word, 12 minimum, please add 20% VAT to total).

Category heading: .....

Name: .....

Address: .....

.....

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.....

.....

Telephone number:

.....

Please photocopy this form or write on a separate sheet if you prefer

Bargain Basement

Bargain Basement adverts now cost £5 per advert (subscribers still free) and will also be published in *RadioUser*, our sister magazine, unless requested otherwise.

Send your advert to
Bargain Basement
Practical Wireless
Warners Group Publications
West Street, Bourne
Lincs PE10 9PH.

Please write your advert clearly in BLOCK CAPITALS up to a maximum of 30 words, plus 12 words for your contact details on the form provided and send it together with your payment of £5 (subscribers can place their advert free of charge as long as they provide their subs number or mailing label). Cheques should be made payable to Warners Group Publishing, credit card payments also accepted.

Please help us to help you by preparing your advert carefully. Any advert which contains ?? marks indicates that the advertising dept. could not read/interpret the wording.

Advertisements from traders or for equipment that it is illegal to possess, use or which cannot be licensed in the UK, will not be accepted.

No responsibility will be taken for errors and no correspondence will be entered into on any decision taken by the Editor on any of these conditions.

You should state clearly in your advert whether equipment is professionally built, home-brewed or modified.

The Publishers of Practical Wireless also wish to point out that it is the responsibility of the buyer to ascertain the suitability of goods offered for purchase.

FOR SALE

AOR AR-8600 MkII, new and boxed with PSU. A bargain at £350, includes delivery. SDR PLAY RSP2 new condition with two SMA to BNC leads and a USB cable. Plus DVD containing the software, £88, including post. Gigabyte Brix i7-5500 2SSDs, 16Gb RAM, Windows 10 Home, £199 ONO.
Tel: Sydney G3SYD 01293 511708 (W Sussex)
E-mail: sydbeauchamp@blueyonder.co.uk

SDR PLAY RSP2 new condition with two SMA to BNC leads and a USB cable. Plus, DVD containing the software £88 including post. Gigabyte Brix i7-5500 2SSDs, 16Gb RAM, Windows 10 Home, £199 ONO.
Tel: Sydney G3SYD 01293 511708 (W Sussex)
email: sydbeauchamp@blueyonder.co.uk

NISSEI 25A PSU, switch-mode regulated voltage type, in near new condition, complete with original box and instructions, £40 (cost £75) plus £8 P&P.
Tel: John G3EGC 01204 301502 (Bolton). E-mail: jvhoba@gmail.com

WS-52 ATU No. 2A with a giant roller coaster. Made in 1944 by the Marconi Co. (Canada), in a wooden case and in very good condition, £80.
Tel: Peter G4VUN 01677 460302 (Ripon)

COLLECTOR SELLING a lifetime's collection of World-War II military radios and airborne equipment. Call for more details.
Tel: Len 07709 221778 (Bognor Regis)

WANTED

HITACHI KM5000 MULTIBAND radio in good working order. Will pay £300 or exchange Zenith Trans-Oceanic D7000Y multiband radio.
Tel: Gary 01885 483870 (Herefordshire)

Redifon 100W HF SSB Transportable Communication Station Type GR479A. Ideally in working condition but anything considered, even just an empty outer housing. Required for project to recreate an RAF Desert Rescue Land Rover circa 1973. Price negotiable.
Tel: Ray M0XDL 01305 833699 (S. Dorset). E-mail: raycoles96@gmail.com

TIPP-EX CORRECTION PAPER, typewriter, white, top copy. Don't throw your stock just because of going on to word processing!
Tel: Godfrey G4GLM, 020 8958 5113.
63 The Drive, Edgware, Middlesex HA8 8PS.
E-mail: cgmm2@btinternet.com

Drake R4B/C receiver. Clean and preferably Unmodified, can collect up to fifty miles from Derby Email : brian.tibbert1942@hotmail.com

Creed 444 or 75 wanted to enter the April RTTY Contest. Please provide a guide price. I am willing to collect within a reasonable distance from London.
Email: g8ubj.io91uj@gmail.com

We know a lot of people use the internet for second-hand sales nowadays but this is a free service for subscribers and very cheap otherwise so please USE IT OR LOSE IT.

Don't forget to make cheques and postal orders payable to Warners Group Publications.

ONLY £5

Bargain Basement order form

Please insert this advertisement in the next available issue of Practical Wireless.

☐ For Sale ☐ Wanted ☐ Exchange

PLEASE NOTE: as a security measure, you must include your house number and postcode.

Name.....

Address .....

.....

..... Post code.....

Telephone Number .....

CARD NUMBER

Signature..... Security number

Last three digits on the back of the card

Switch issue number (if on card) .....

Start date of card..... Expiry date of card.....

My Subs Number is.....(or send mailer label)

PW & RU ☐

PW ONLY ☐

Please make any cheques or Postal Orders for advertisments payable to Warners Group Publications.

		(30)	

CONTACT DETAILS FOR ADVERT. Please only write in the contact details you wish to be published with your advert, ie. do you want your name & address, or just your telephone number? Your advert, you decide! PLEASE - No FAXed Ads! (12)

Traders Table

The equipment for sale on these pages is second hand or ex-demonstration

Nevada 023-9231 3090

1. Acom 2000 U Tube 2kW Auto Amplifier with manual £4250
2. Yaesu FTDX-5000 U + XF-126N 300Hz roofing Filter £2595
3. Yaesu FT1000MP U + SP8 speaker & MD1-B8 Mic £999.95
4. Yaesu FTM400DR/E U VHF/UHF Digital mobile transceiver £349
5. Yaesu FT450AT U HF+6m 100W Transceiver £469
6. Yaesu VR5000 U Wideband Scanning receiver £450
7. Icom SP-33 U Quality extension speaker £99
8. Icom IC2200H U 65W 2m mobile Transceiver £185
9. Icom ID-51E U D Star H/H +(£190 of accessories) £299
10. Kenwood MC-90 U Desk Microphone £145
11. Alpha Delta U Heavy duty 4-way coax switch £65
12. Alinco DX70 U HF+6m Transceiver + Adonis base mic. £399
13. Alinco DX-R8E U Communications Receiver £379
14. Alinco DM30E-ED..NEW 20-30A power supply £85
15. Alinco DR135 U 28 MHz multi-Mode transceiver £129
16. Alinco DR138H-ED..high power 145MHz FM mobile £139
17. Alinco DRB185-ED..85w 145MHz FM mobile transceiver £149
18. Alinco DR638H-ED..high power 145/433MHz mobile £235
19. Alinco DR735E-ED..NEW MODEL twin band 145/433MHz £269
20. Alinco DX-SR9E-ED..hybrid SDR/100w HF transceiver £579
21. Alinco EDX2-ED..automatic HF antenna tuner £269.95
22. Antex 690D-ED pro-style digital soldering station £175
23. Antex TCS-ED soldering iron with temp control £59
24. Anytone AT588-U..145MHz FM mobile transceiver £99
25. Anytone QHM-02-CL..DTMF hand microphone AT5189 £19
26. Butternut U HFV-6 Band Vertical – 26ft tall £399.95
27. Collins MS6 U Mechanical Filter £74
28. Cable 100M Drum U 8D-FB Japanese Low loss £199.95
29. Cable 50m length U 10D-FB Japanese Low Loss £99.95
30. Cable 50m length U 8D-FB Japanese Low Loss £99.95
31. Cable 100m length U LDF450 U Low Loss £299
32. Comet TF-400 U 400W current Balun £69
33. Daiwa PS-304 MK11 30A (peak) Linear power supply £79.95
34. DX Engineering U RR8 8-way remote antenna switch £375
35. Dunestar U set of 9 Band pass filters 160m – 10m £445
36. EZ Catapult wire launcher U for wires over trees £55
37. Fody Tempus Pro-ED Bluetooth (BLE) weather station £69
38. Heil Proset U Headset with HC4 mic. (no box) £59
39. Heil Proset U Headset + HC4 + Yaesu leads & foot switch £69
40. Heil FS-2 Footswitch £39
41. MFJ 998 U 1.5kW Automatic HF Intelligent tuner £659.95
42. MFJ 969 300W U 160m – 6m Antenna Tuner £179
43. Midland Arctic-ED waterproof marine handheld radio £89
44. Midland D200-ED..digital/analogue PMR licence free radio £125
45. Midland G7Pro-U latest style Pair PMR 446 handhelds £49
46. MyDel MP4128 U 25A switch mode Power supply £39
47. Nevada PS30M-ED..30amp variable voltage power supply £90
48. Nevada PS40M-ED..40A variable voltage linear PSU £99
49. Nevada PSW50-ED..50A switch mode supply £119
50. Palstar AT2KD -ED..2Kw manual antenna tuner £569
51. Palstar AT500-ED..600w differential antenna tuner £499
52. RadioShack U DX394 Communications receiver £129
53. Tecadi Poles U set of 11 Fibre poles £75
54. Watson CX-SW3N U Low loss 3-way N type switch £44
55. West Mountain U RigBlaster Plus (wired for Icom) £79

CL - Clearance **ED** - Ex-Display **U** - Used

Short Wave Shop 01202 490099

TRANSCEIVERS

ALAN HP450 2A RUGGED with desktop charger And kit case....40
ALINCO DJ-S11....75
ICOM IC-7000....POA
ICOM IC-7700 WITH KEYBOARD AND MIC....POA
ICOM IC-756....590
KENWOOD TH-F7E....190
KENWOOD TMD700E....230
KENWOOD TS 850S BOXED....599
YAESU FT690R MK2 + FL-6020 LINEAR AMP....420
YAESU FL-6020....POA

AOR AR7030 WITH WHIP ANTENNA, PSU, REMORE AND MANUAL....POA
ALINCO DJ-X2....110
ALINCO DJ-X7....160
COMMTEL 214 SPORTSCAN....50
ICOM IC-R10....165
ICOM IC-R71E....349
ICOM IC-R75....550
JRC NRD-525....349
ROBERTS R-871....75
SANGEAN ATS 909....150
SONY SW100....159
UNIDEN UBC30....50
UNIDEN UBC360CLT....85
UNIDEN BEARCAT UBC 120 XLT....120
UNIDEN BEARCAT UBC 220 XLT....79
UNIDEN SPORTCAT UBC 180 XLT....100
UNIDEN SPORTCAT UBC 280 XLT....110
YAESU FRG 7700....199
YAESU FT-990....799
YAESU VR500....165
YUPITERU MVT-7100....139

ACCESSORIES

AV200 SWR....55
AV200....40
BHI NEIM 1031 NOISE REDUCER WITH STAND AND SPEAKER....135
ICOM AT-150 Tuner....125
ICOM PS-55....75
JRC MVA 319 SPEAKER....145
MANSON EP-925 25AMP PSU....75
MFJ-260C Dummy Load....45
MFJ 392B HEADPHONES....15
MFJ 956 ANTENNA TUNER....59
MFJ-969 ATU....from 125
MFJ 993B....199
MICRONTA 22-220 MULTIMETER....15
MORSE KEYS – Various Prices From....15
MRP2000 PRE AMP....25
NAG 144XL AMPLIFIER....385
PS85 PSU....145
PALSTAR MW550P PRE-SELECTOR & PSU....225
RS NISSEI 502 SWR/POWER METER....65
SCANMASTER SP-55....35
STAR-MASTERKEY II....55
TRIO AT230 WITH STATION MONITOR SM220....300
VARIOUS PADDLE KEYS – various prices....POA
VARIOUS DIP METERS – Various prices from....35
YAESU SP-6 EXTERNAL SPEAKER....110
YAESU MH-31 MIC....20
ZETAGI V3 3 WAY ANTENNA SWITCH....15

PLEASE SEE OUR NEW WEB SITE :-
http://www.shortwave.co.uk

Disclaimer Advertisements from traders for equipment that is illegal to possess, use or which cannot be licensed in the UK, will not be accepted. While the publishers will give whatever assistance they can to readers or buyers having complaints, under no circumstances will the magazine accept liability for non-receipt of goods ordered, late delivery or faults in manufacture.

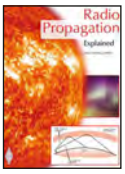
Radio Book Store

Order form on page 71

THE VINTAGE RIG GUIDE

Amateur radio equipment saw great changes from the 1960s onwards with the arrival of solid-state designs and there is much superb equipment from the latter decades of the 20th century available in the second-hand market. This brand new publication focuses on the amateur radio equipment from theses decades in the same format as the *The Rig Guide*, describing the basic information about the equipment, along with when it was first made and what it may be worth.
Price: £5.99 plus p&p.

RADIO PROPAGATION EXPLAINED



Understanding radio propagation is essential for anyone with an interest in radio communications who wants to know how signals travel from A to B. Written by acknowledged expert Steve Nichols G0KYA, *Radio Propagation Explained* provides everything you need to know about this fascinating topic.
Price: £12.99 plus p&p.

RESTORING OLD RADIO SETS

For many, there is nothing more charming than an old broadcast receiver glowing away in a substantial wooden or Bakelite case. However, these are now a rarity and it is much more likely that old radio sets will be non-working curios found at car boot sales in a dusty, unloved condition. *Restoring Old Radio Sets* is a book that sets out to provide a step-by-step guide to bringing an old set back to life, getting it working properly and restoring its looks. **Price: £8.99 plus p&p.**

HF SSB DX BASICS

Contacting far flung parts of the world (DX) on the High Frequencies (HF) on single side-band (SSB) is one of the enduring fascinations of amateur radio. *HF SSB DX Basics* provides a practical guide to making the most of this endlessly fascinating area of operation. **Price: £8.99 plus p&p.**

RSGB WORLD PREFIX MAP - RADIO AMATEUR'S MAP OF THE WORLD

This quality map is printed on top quality silk finished paper. Not only does it show the location of worldwide prefixes, there is also an A-Z list of prefixes and expanded map sections covering the Caribbean and Europe, making them much easier to read. This map will grace the wall of any shack. **Price: £6.99 plus p&p.**

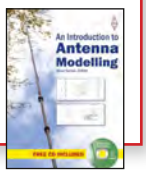
LF TODAY: A GUIDE TO SUCCESS ON THE BANDS BELOW 1MHZ

Low frequency operating has never been more popular and the introduction of a new international amateur allocation at 472kHz means that, with 136kHz, there are now two bands below 1MHz. LF Today distils nearly twenty years experience of the low frequencies and aims to help you get the most out of operating in this part of the spectrum. In short, *LF Today* is a one-stop shop for anyone seeking information on amateur radio operation below 1MHz. **Price: £13.99 plus p&p.**

RTTY/PSK31 FOR RADIO AMATEURS

Data modes appear to be a daunting prospect to newly licensed radio amateurs but they do not have to be. This book is a practical guide to the two most popular data modes, RTTY and PSK31. However, *RTTY /PSK31 for Radio Amateurs* does carry a warning: Buying this book may lead to an enjoyment of RTTY, PSK31 (and Data modes in general) which is highly addictive!
Price: £7.99 plus p&p.

AN INTRODUCTION TO ANTENNA MODELLING



For many years, the only way for most radio amateurs to work out how well an antenna design would work was to build it and find out. The arrival of computer based antenna modelling programmes has changed this. This book looks at the Free MMANA-GAL antenna modelling program that will let you design and optimise a whole host of antennas and all on your PC. **Price: £9.99 plus p&p.**

RADIO LISTENER'S GUIDE 2017 EDITION

The *Radio Listener's Guide* is an annual guide for UK radio listeners. It is packed with news, radio reviews and station information. This year's edition includes reviews of personal radios, analogue portable radios, clock radios, DAB radios, internet radios, mini systems and tabletop radios. You'll also find our list of recommended best-buys.

The *Guide* is full of information about analogue and DAB digital radio stations. You'll also find details of radio carried on the main TV platforms as well as information about Internet radio and podcasts. This year, we have looked at the latest developments with new technology – including BBC iPlayer, Radioplayer's new in-car device and the Amazon Echo Dot.

Frequency and transmitter information is listed for UK and Irish national, local and community stations. Our frequency indexes, for both FM and AM, will help you to identify unknown stations.

The *Radio Listener's Guide* is your indispensable guide to UK radio. **£5.95**

	Pages	Price
SCANNING & FREQUENCY GUIDES		
● **WORLD RADIO TV HANDBOOK 2017**	672	£35.00
● **RADIO LISTENER'S GUIDE 2017 Edition**	160	£5.95
● **SCANNERS 7** B Robertson & P Rouse	245	£9.95
ANTENNAS/PROPAGATION		
● **AN INTRODUCTION TO ANTENNA MODELLING** Steve Nichols G0KYA (RSGB)	80	£9.99
● **NOVEL ANTENNAS** Steve Telenius-Lowe PJ4DX (RSGB)	192	£14.99
● **ANTENNAS MASTERED** Peter Dodd G3LDO (RSGB)	288	£14.99
● **STEALTH ANTENNAS 2** (RSGB)	208	£14.99
● **RSGB ANTENNA FILE** (RSGB)	288	£14.99
● **HF ANTENNAS FOR EVERYONE** (RSGB)	336	£14.99
● **BUILDING SUCCESSFUL HF ANTENNAS** (RSGB)	224	£14.99
● **HF ANTENNA COLLECTION** Edited by Erwin David G4LQI (RSGB)	233	£19.95
● **PRACTICAL WIRE ANTENNAS 2** Ian Poole G3YWX	172	£11.99
BEGINNERS/LICENCE/MANUALS		
● **HF SSB DX BASICS** Steve Telenius-Lowe, 9M6DXX (RSGB)	96	£8.99
● **RADIO PROPAGATION EXPLAINED** Steve Nichols G0KYA	128	£12.99
● **HAMSAT** (RSGB)	128	£9.99
● **GETTING STARTED IN AMATEUR RADIO** (RSGB)	96	£8.99
● **TECHNICAL FOR THE TERRIFIED BOOK 2** (PWP)	128	£12.99
● **TECHNICAL FOR THE TERRIFIED BOOK 1** (PWP)	124	£12.99
● **ADVANCE! THE FULL LICENCE MANUAL** Alan Betts G0HIQ & Steve Hartley G0FUW (RSGB)	104	£11.99
● **AMATEUR RADIO EXAM SECRETS** Alan Betts G0HIQ (RSGB)	104	£12.99
● **FOUNDATION LICENCE NOW! 5th Edition** Alan Betts G0HIQ (RSGB)	32	£4.99
● **HF AMATEUR RADIO 2nd Ed.** Ian Poole G3YWX (RSGB)	144	£12.99
● **INTERMEDIATE LICENCE – BUILDING ON THE FOUNDATION 4th Edition** Steve Hartley G0FUW (RSGB)	76	£6.99
● **MORSE CODE FOR RADIO AMATEURS** (RSGB)	32 inc. CD	£8.99
● **SECRET OF LEARNING MORSE CODE** Mark Francis (Spa)	84	£6.95
DESIGN & CONSTRUCTION		
● **HOMEBREW COOKBOOK** (RSGB)	208	£12.99
● **CIRCUIT OVERLOAD** (RSGB)	504	£18.99
● **THE ART OF SOLDERING** R Brewster (Babani)	84	£3.99
● **BUILDING A TRANSCEIVER** E Skelton EI9GQ & E Richards G4LFM (RSGB)	176	£12.99

	Pages	Price
SHACK ESSENTIALS		
● **WORLD PREFIX MAP** (RSGB)	980x680mm	£6.99
● **RTTY/PSK31 for Radio Amateurs** Roger Cooke G3LDI (RSGB)	48	£7.99
● **LF TODAY** Mike Dennison G3XDV (RSGB)	192	£13.99
● **RSGB YEARBOOK** 2017 edition (RSGB)	544	£19.99
● **RSGB AMATEUR RADIO OPERATING MANUAL** 8th edition (RSGB)	240	£16.99
● **NEW DELUXE LOGBOOK & DIARY 2017** (RSGB)	80	£4.99
● **NEW THE RIG GUIDE** S W White (RSGB)	96	£5.99
● **NEW HART REVIEWS** (RSGB)	192	£12.99
● **RSGB PREFIX GUIDE** 12th edition (RSGB)	80	£9.99
● **SIX & FOUR** Don Field G3XTT (RSGB)	288	£13.99
● **AMATEUR RADIO ASTRONOMY 2nd Edition** J Fielding (RSGB)	384	£16.99
● **DXPEDITIONING - BEHIND THE SCENES FOR RADIO AMATEURS WORLDWIDE** N Cheadle & S Telenius-Lowe	180	£6.95
● **AMATEUR RADIO ESSENTIALS** G Brown (RSGB)	288	£25.99
QRP		
● **QRP BASICS** George Dobbs G3RJV (RSGB)	204	£14.99
VHF & HIGHER		
● **MICROWAVE KNOW HOW** Andy Barter G8ATD (RSGB)	192	£12.99
HISTORICAL		
● **THE VINTAGE RIG GUIDE** Steve White G3ZVW	80	£5.99
● **RESTORING OLD RADIO SETS** Phlilip Lawson G4FCL	80	£8.99
● **THE LONG SILENCE FALLS VOLUME II** The Life & Times of a Merchant Radio Officer 1900-2000	376	£25.00
Ross Bradshaw	152	£16.99
● **INSTRUMENTS OF AMPLIFICATION** H P Friedrichs	300	£14.95
CRYSTAL SETS		
● **THE VOICE OF THE CRYSTAL** H Peter Friedrichs	185	£11.95
ELECTRONICS		
● **COMPUTERS IN AMATEUR RADIO** with CD (RSGB)	256	£14.99
● **TEST EQUIPMENT FOR THE RADIO AMATEUR** (RSGB)	250	£14.99

GETTING STARTED IN AMATEUR RADIO

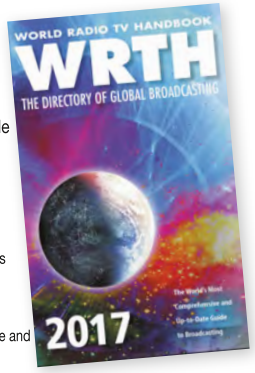
If you want to know something about the hobby or are newly licensed or are even just looking for something different, *Getting Started in Amateur Radio* provides the answers. What about receiving digital images from the International Space Station? Or talking to friends around the world via satellite? Or perhaps being able to help out during natural disasters? All of these things are possible with amateur radio and *Getting Started in Amateur Radio* details these and many other possibilities.

£8.99

Getting Started in Amateur Radio provides information on the activities to explore when using your first VHF/UHF or HF station and what other equipment you might need.

WORLD RADIO TV HANDBOOK 2017

The Directory of Global Broadcasting



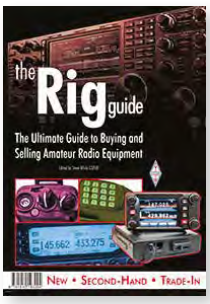
The best selling directory of global broadcasting on LW, MW, SW & FM.
This is the 71st edition of *World Radio TV Handbook* and this great directory continues to offer the most comprehensive guide to broadcasting on the planet. It provides the most up-to-date information on medium wave, short wave and FM broadcasts and broadcasters available in any publication.

- The Features section for this 71st edition contains articles on Remote Receivers, A Pacific Radio Adventure, The Mighty KBC Station, CKZN St. John's, and the International Radio for Disaster Relief Project as well as equipment reviews and other articles of interest.
- The remaining pages are, as usual, full of information on:
- National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts and more, including Clandestine and other target broadcasters.
- International SW broadcasts by frequency in English, French, German, Portuguese & Spanish.
- International MW frequency lists by region; broadcasts in English, French, German, Portuguese and Spanish by UTC as well as DRM schedules.
- Reference section with Transmitter locations, DX clubs, Internet Resources, and much more.
- Articles on topics of great interest to professionals, listeners and DXers alike.
- Reviews of the latest receivers and equipment.
- Fully-updated maps showing global SW transmitter sites.
- Features – Colour pages with articles, radio reviews, propagation predictions, and colour maps.
- National Radio – The world's national radio services, and the broadcasters, listed by country.
- International Radio – Full broadcaster details and the winter SW frequencies as supplied by the broadcasters together with an expanded Clandestine section.
- Television – Details of the broadcasters arranged alphabetically by country.
- Reference – International and domestic SW transmitter sites, standard time and frequency transmissions, DX club information, internet resources and other essential information.

£35.00

THE RIG GUIDE. £5.99

What should you pay for a second-hand radio?



The Rig Guide is a unique publication that sets out to answer the question 'what is the right price for this radio?' What will you get for a radio if you trade it in or try to buy or sell it on an online auction site? - *The Rig Guide* provides the answer.

The Rig Guide continues to define the prices of amateur radio equipment in the UK. It has been fully updated and is now covering more than ever. This is why *The Rig Guide* is rightly one of the most popular amateur radio books around.

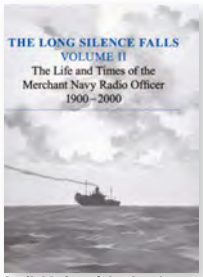
If you are planning to buy or sell any amateur radio equipment, you should not be without *The Rig Guide*. The book begins with tips for buyers and a guide to selling and trading. There is a handy guide to selling on ebay and even tips on how to avoid getting lumbered with stolen gear. *The Rig Guide* contains a list of the abbreviations used in the descriptions and an explanation of them all. Amateurs trust RSGB reviews and a full list of *RadCom* reviews since 1990 is included and when a piece of equipment was reviewed by *RadCom*, it is highlighted on the listing.

The Rig Guide isn't limited to popular commercial amateur radio transceivers but also covers receivers, scanners and linear amplifiers too. You'll find extensive lists of past models from Acom to Yaesu, with over 20 manufacturers listed, including Icom, Ten-Tec, Kenwood and so on. We're not just talking about current models either and you will even find details on the many Chinese manufacturers. DSP isn't forgotten either, with a dedicated section on the equipment available. Overall, *The Rig Guide* contains details of around 400 pieces of amateur radio equipment covering HF, VHF & UHF. Each item is described with an easy-to-understand listing that covers its main features, band coverage and other features, including a photograph of the equipment.

Knowing the worth of any piece of equipment means you can easily recover the cost of *The Rig Guide* with just one purchase or sale.

THE LONG SILENCE FALLS VOLUME II

The Life and Times of the Merchant Navy Radio Officer 1900-2000



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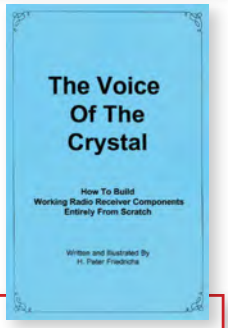

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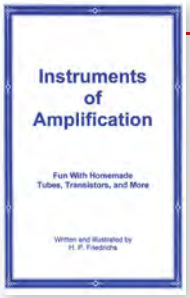

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Decode *Mike Richards has news on a wide range of exciting hardware and software this month, helping you to get the best out of your monitoring and decoding projects*

Military Matters *Pat Carty provides some first-hand information on US and UK aircraft carriers, reports on Exercises Chameleon and Saxon Warrior 17 and visits the Russian Army 17 Exhibition*

Book Review *David Harris evaluates The Golden Days of Radio One: Hotshots, Big Shots and Potshots, by David Hamilton*

Sky High *Godfrey Manning points to more sources of accurate aeronautical information and looks at aerodrome radio in the past and at aspects of contemporary communications*

DXTV, FM & Satellite News *Keith Hamer and Garry Smith offer a seasonal feast of TV and FM DX reception reports, due to favourable atmospheric conditions and Sporadic-E propagation*

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Airband News *David Smith delves into the history of GPS infrastructure and is concerned about drones around airfields. He also outlines a noteworthy engineering career scheme for women*

LM&S Broadcast Matters *Chrissy Brand winds up her recent Canada on-the-road radio movie, reacts to readers' listening reports and introduces a new short wave radio station*

Radio RIAT 2017 *In this feature, Ian Doyle writes on how he monitored RIAT 2017, describing his extensive preparations, location, multi-receiver setup and major catches*

The bhi ParaPro EQ20B-DSP *Mike Richards shines a reviewer's spotlight on the new bhi ParaPro EQ20B-DSP combined equaliser, noise reduction unit and audio power amplifier*

Radio Websites *Chrissy Brand evaluates the pick of this month's most fascinating radio-related websites and finds some real gems for both radio enthusiasts and researchers of radio's political history*

Off the Record *Oscar the Engineer explains free radio terminology, looks at adaptive frequency selection and evaluates recent transmissions by Pirate BBC Essex 2017 and Radio MiAMiGO*

Comms from Europe *Simon Parker relates the highs and lows of his recent personal experience with CB transceivers, introduces some new offerings by President and Stabo and assesses recent band activity*

Software Spot *This month, QSP73 Services offers another stimulating collection of radio-related hobby software, including programs to enhance your contest activities and data modes monitoring*

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Review – Wonderwand Antennas
Carl Gorse 2E0HPI has been checking out some more antennas suitable for portable operation.

Valve & Vintage
Michael Marinaro WN1M continues the saga of Fabbri and the fight to achieve reliable transatlantic communications.

Rejuvenating the FR-50B
Dr Samuel Ritchie EI9FZB has the second part of his restoration story.

The National Hamfest and 2017 RSGB Convention
We have our annual reports on the happenings at Newark and at the RSGB Convention.

Antipodal Focusing
Steve Telenius-Lowe PJ4DX follows up his article on using the low bands during the solar minimum by explaining the ins and outs of antipodal focusing.

In the Shop
Harry Leeming G3LLL relates a tale from the early days of transistors, advises caution where insurance is concerned and has some more anecdotes from his retail days.

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